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HENRY H. MILES, Esq., LL. D., D. C. L.,

ASSISTANT-SECRETARY OF THE MINISTRY OF PUBLIC INSTRUCTIONS AND

GEORGE W. COLFER, Esquire.

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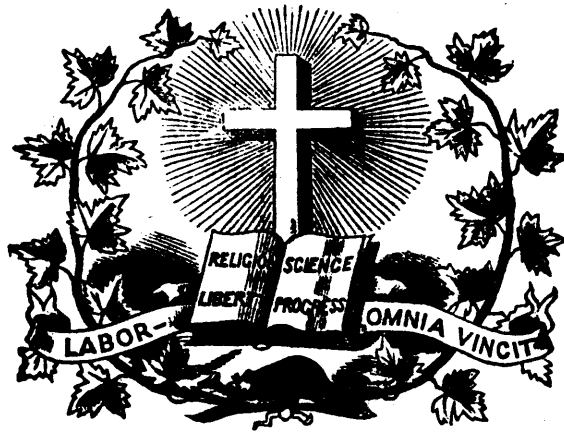
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ON SCHOOL BUILDINGS AND FITTINGS. (')

By T. ROGER SMITH.

This very wide subject is one which it is impossible to embrace fully within narrow limits of a single paper, and it becomes therefore necessary to select a portion of it for consideration. I have judged that the most useful course will be to consider the buildings and fittings of public elementary schools, such as are now required in every part of England, and public middle-class schools, the call for which is beginning, and only beginning, to make itself felt; and I shall not attempt to pursue the many ramifications into which the subject might extend. Did time permit, we might consider, on the one hand, private and boarding schools, science schools, colleges, and the buildings required for the higher education; or, on the other hand, reformatories, refuges, parochial schools, and schools for the blind or the deaf and dumb; but it is the less to be regretted that these must be left out, since much of what is useful in arranging elementary and middle public schools will be equally useful in other cases.

If we commence where elementary education itself begins, namely, with the infant school, we shall find the circumstances for which the architect has to make provision to be very much as follows.

(') Read before the Society of Arts, on Wednesday, 25th November.

A considerable number of little children, many of them quite unused to any discipline, and all restless and childish, are to be trained, reduced to order, instructed, and prepared for entering a higher school; and for this arduous work the services of one or two teachers, and one or two young assistants, are obtainable.

Little personal attention can be given during school-hours to an individual child, for if the teacher's eye is taken away from the group, discipline relaxes; but as a compensation for this, the influence which the teacher can exert over the children in a mass is extraordinary, and produces the most salutary effect upon each component of that mass. It is accordingly necessary, as much as possible to keep the children grouped under the teacher's eye. In addition to a provision for this purpose, space, in which exercises more resembling drill than anything else, can be carried on, is essential; for the restlessness natural to a very young child cannot be long controlled, and frequent change of occupation and position is necessary, and should be so provided and regulated as to form part of his training.

We must, in order to meet these requirements, provide a large room, with plenty of unoccupied space, in which our infants can march about; and we must provide a sloping group of seats on which they can sit, clustered together, and directly under the eye of their teacher. It is particularly essential that the room should be sweet, sunshiny, and cheerful; and to obtain these ends we should give it a considerable height, introduce ample windows, obtain a sunny aspect for it, and give it a little simple decoration. Lastly, it is desirable that when the children look at the teacher, and he at them, his face and their faces should be well and naturally lighted, with nothing to dazzle either. To accomplish this we must provide, if possible, a skylight over the raised seats, or, as they are usually but somewhat unsuitably called, the "gallery." The programme upon which a good infants' school-room can be built, and one which is not now often departed from widely, is therefore ample clear space, raised top-lighted gallery, and plenty of light, ventilation, and sunshine.

Among the infants there will be considerable variations, some of the younger will be brought who are too childish

for it to be interested in the lessons which the generality can follow, and these, if not weeded out, will destroy discipline; others, among the elder, will have acquired, before passing into the higher schools, some power of application and some knowledge of writing, and even ciphering. The very little ones are best drafted off into a room by themselves, where they can be kept amused; this room is called the babies' room. For the most advanced, desks and benches must be provided in the school-room, at which they can write, with sometimes a smaller separate gallery on which they can have a collective lesson; but where the school is at all large, there will be enough children answering to this description to render desirable the provision of a second classroom for them, in which can be partly removed from the noise and movement of the general room.

Here we find added to the school room the class-room, a significant feature, not forming part of the earliest infant schools any more than of earliest schools for older children, but adopted on account of its great utility, if not necessity. And the further we go the more importance shall be learned to attach to the provision of separate rooms for separate classes.

It is always desirable for infant schools to be on the ground floor, as the steps up to a school room on an upper floor, which are no very serious evils in the case of some advanced children, are dangerous and difficult for infants. A width of 24 to 25 feet is desirable for the general school-room, and the education department requires the area of school and class rooms together to reach eight feet of floor for each infant. It is not considered that more than 250 infants can be, as a rule, managed with success under one head teacher of ordinary capacity; and if the requirements of the district call for a larger amount of accommodation, it will be better to build two infant schools. It is also considered that 70 is as large a number as one teacher can usefully instruct at one time, and therefore the largest gallery in an infant school had better not seat more children. In very large infant schools two such galleries may be placed side by side, with a sliding partition to separate them.

The fittings of an infant school are simple, and must be adapted to the size of the children. The gallery, the one fitting peculiar to the infant schools, is a platform broken into broad steps, of no great height. In some schools the infants sit on these steps, but it is far better to provide little seats, furnished with backs, the seat boards fixed a trifle above the step. The children sitting behind are not so liable to kick or disturb those in front where there are seats as where there are not. Gangways of shallow steps are formed at each side, and the sides are enclosed. It is not well for infants to sit more than six deep on a gallery, and generally five deep is enough. It is advantageous to be able to place the gallery partly in a recess, so as to leave the school-room floor less interfered with, and also so as to obtain a skylight. Such benches and desks as are used in the room may correspond (except in height) with those required for higher grades, but I think desks with flaps ought not to be used. Most infant-teachers prefer desks with a flat top, as kindergarten toys can be placed on them without their rolling off, and I have seen them used with a slate top. Simple stands or easels for diagrams, and some other matters of this sort, are required also, but these are perhaps more furniture than fittings.

The playground, never unimportant, is, in the case of the infants' department, almost more a part of the school than a place where the children are to be left to do just what they like, and it requires constant superintendance and careful preparation to its purposes. A good covered play ground is almost essential for infant children; and

it is very customary, and I believe very advantageous, for the playground to have a few simple pieces of gymnastic apparatus, such as parallel bars, &c. It is, I believe not found advisable in practice to make the girls and the infants share the same playground; even a small space entirely their own, and under the eye of their own mistress, will be more advantageous to infants than a share in a large playground, where the elder children will find them in the way, and treat them accordingly.

When public attention was first turned to the education of the multitude in this country, the sort of training in the mass which I have sketched out as suitable for infant children was applied to those of more advanced years. This was the famous system of Bell and Lancaster. It was in 1798, two years before the present century opened, that Lancaster opened his first school, and the type of building which his method required was widely different from that which we have arrived at after three-quarters of a century of modifications as can well be conceived; so that those who, like myself, consider that a perfect model has not yet been attained, may very well hope to see further modification take place.

I well recollect, when exceedingly young, being occasionally taken to see the Lancasterian schools of the large north-country town where I was born, carried on in buildings erected for the purpose, and which may be taken as a fair sample of the Lancasterian school-house. The school room was nearly square, lofty, and I think airy and fairly lighted, but most forbidding and grim in aspect. The scholars, who were partly looked after by selected scholars called monitors, sat so as to form a compact square phalanx under the head teacher's eye, and very large numbers were taught in one school under such a system; indeed Lancaster is reported to have said that he should not shrink from conducting a school of 1,000 scholars in one room. The instruction given by the chief teacher under such a system as this must necessarily have been simultaneous, and no large amount of attention can possibly have been given to individual pupils; indeed, I doubt whether the head master had any easier mode of access to the boys in the middle of the block than by walking over the desks till he came to them. At any rate, I recollect to have seen this done.

From this original starting-point a series of modifications has been introduced into the methods of teaching, all tending to secure more separation of classes, and more possibility of aiding individual scholars in their work. In 1834, grants of public money began to be made towards school-houses, and in 1839 the Committee of Council began to administer these grants. In 1840, instructions and plans of schools were first published by the Committee as a guide to those proposing to build; and the type of building which they embody, and which has been repeated hundreds and thousands of times since, is adapted to a system far removed from that of Lancaster.

The pupil-teacher has now taken the place of Lancaster's monitors. A pupil-teacher is a promising scholar apprenticed to learn the business of teaching, and available as an auxiliary teacher, and earning a small payment. Assistant teachers were also introduced; these are, of course, more experienced than the pupil-teachers, and more highly paid.

Teachers were now sufficiently numerous in proportion to the number of children to render it possible to break up the school into distinct classes, each one under an assistant teacher or pupil-teacher. It was desirable to separate the classes one from another, and yet not to remove them from under the teacher's eye, so that if the pupil-teacher got into difficulties the head teacher might perceive it quickly and come to his help. When this

system was first worked out in British schools, the classes were planted about in different parts of a large room, an arrangement to this day adhered to in many places, and to be found in nearly all Sunday schools, and, if I mistake not, in some of the elementary schools of Scotland and of Yorkshire.

But the isolation to be obtained in this way is very incomplete; there is no mitigation of the noise of teaching, and no means exist of preventing the children's attention from being constantly diverted from their work by what takes place in any other part of the room.

The Committee of Council introduced an arrangement which very much diminished these evils. They recommended that classes should be arranged along one side of the room only, and fixed—partly, I believe, from motives not directly connected with school discipline—16 feet as a minimum and 20 feet as maximum width for the school-rooms, and they prescribed that the children should, when in class, sit no more than three deep.

This, of course, led to very long narrow rooms, which were often shaped like an L or a T on plan. Curtains were generally provided for the spaces separating the classes, but from the angle of the L or T the head teacher could pretty well see all the classes. Of the width of these narrow rooms less than half is ordinarily occupied by the three benches and their desks, so that their is ample space for the teacher to draw out a class from their seats and make them stand round him. Such school-rooms generally have windows on both sides, admitting good ventilation, but often giving cross lights; they are carefully arranged so that no fire-place or door shall interfere with the unbroken continuity of the wall against which the classes are planted. One or two class-rooms were thought ample for a large school of this sort; and the whole arrangement, with which probably every one in this room is personally familiar, though open of course to objections, has many points of practical excellence to recommend it. It is appropriate to the system of teaching; it admits, generally speaking, of being economically carried out, and yet may be made picturesque; but its chief merit was that it was the plan, and I believe it is correct to add, the only plan, towards carrying out which the Committee of Council would sanction money payments so long as these payments were under its control.

The passing of the Elementary Education Act has opened the door for fresh modifications to be introduced, and it might perhaps be interesting to inquire in how many different directions modifications have been attempted by different School Boards throughout the country.

It will, however, I think, be more useful to describe what has come under my own immediate notice in the plans introduced by the School Board for London, and which are the results of thoughtful and practical consideration of the problem by many persons of varied and great experience. These plans in several essential particulars depart from the original programme of the Committee of Council, and the changes introduced into them constitute an immense step in advance.

In crowded neighbourhoods where land is very dear, accommodation for large numbers had to be provided; it consequently seemed essential to have high buildings. Schools of two and three stories, with in some cases covered playgrounds, were accordingly decided upon.

The stereotyped arrangement of desks three deep had not been strictly adhered to by all teachers. Many found it quite practicable to teach children four deep, and even five deep, without disadvantage. It was accordingly decided from the first to abandon it, to build wider school-rooms, usually 22 feet wide, and to arrange the children in deeper rows. After a time the whole question of placing the children was revised, and fittings,

by which their desks and seats are arranged in pairs, so that every boy or girl can be readily reached by the teacher, were adopted. To these we shall return later on.

More radical, however, were the changes desired to be brought about in the accommodation of the classes, and in the lighting of the children's seats.

In most of the Board-schools half the number of children are taught in the school-room and half in class-rooms. The Revised Code provides for six grades of proficiency in children, and this has led to the idea that six classes should, as a rule, be provided for in planning a school. In practice, there are more children of the lower grades than of the higher in every school; but those in the higher grades are larger children, and require more space, so that a common custom has been to provide in a department (that is to say, in a boys' or girls' school) three class-rooms and a school-room capable of seating three other classes. In many cases two classes are placed side by side in what is called a double class-room, which can be divided into two by closing a moveable partition. It by no means follows that these arrangements are uniform. Sometimes there are four class-rooms; sometimes the class-rooms are built for rather larger classes than those in the school-room, and sometimes the opposite is the case, but the proportion has been generally pretty well observed. The class-rooms at first were required all to open direct out of the school-room. It is now considered desirable—which it was not at first—to have the power of assembling or dismissing a class working in a class room without its being essential to pass the children through the school-room. The class-rooms are generally 20 feet from front to back; this gives, if 10 feet of floor is provided for each child, 20 feet as the width of a class-room for 40, and a room 20 feet by 20 can be very conveniently seated for 40 with dual desks; 9·0 is, I think, the minimum area per child in a school-room or class-room.

The class-rooms are ordinarily provided with windows on at least two sides, and the school-room with windows back and front, and, where possible, at the ends. These afford good means of getting through ventilation, and a fair amount of left-hand lighting; in fact two of the three classes in class-rooms, and one class of the three in the school-room, can obtain a good left-hand light.

The reason why lighting from the left is good will be obvious when you reflect that in writing and cyphering this is the only side light which prevents the shadow of the hand from interfering with the work. The advantage of side light over light from behind the children is that the teacher is not dazzled, and the children's faces are not lost to the teacher, and the children do not sit in their own light. The advantage side light possesses over light from behind the teacher is that the children are not dazzled, and that their teacher and his diagrams are easily seen.

The rule of lightning from the left cannot be completely carried out, except when the teaching in class-rooms, for if in a school-room, when several classes are taught, you attempted to place the children with their seats at right angles to the wall, you would be landed in a series of inconveniences so grave that they could not be tolerated. Nor can the rule of lighting only from one side be easily reconciled to that passion for through ventilation by means of a direct current of wind from window to window which has so strong a hold upon those experienced in school management as well as hospital management in England. Accordingly the practice with regard to school rooms has been at the best a compromise. As much side light as is obtainable has been in some of the recent London schools procured from the ends of the

general school-room, but for the majority of the classes there taught windows both back and front are commonly supplied.

In Prussia, where school management has been deeply studied and carefully thought out, it has long been a cardinal rule that every class occupies a separate class room, and that every scholar in the class shall receive the light from his left hand. What has been done in the London schools is an approach towards applying these two rules, but falls short of perfect conformity to them.

It is not, perhaps, easy, so long as the pupil-teacher system prevails, to conduct the whole teaching in class-rooms; but if the conditions are manifestly better than those obtainable in a school as at present conducted, it seems clear that a strenuous effort ought to be made to secure the advantage of the class-room system; and if it and the pupil-teacher system seem to clash, that such modifications should be made in the latter as will suffice to reconcile the two. The difficulty arises from the fact that a teacher, shut up in a room with forty, fifty, or sixty children to manage, requires to be a person of much more experience and judgment than an ordinary apprentice, and that therefore a school made up of class-rooms seems to call for a series of a highly paid assistant teachers. I venture, however, to think that by working the class rooms in pairs, two together, a close approach to the perfect class room system may be made without giving up pupil teachers, and without that revolution in our mode of training instructors for elementary schools, and that considerable increase in the cost of conducting such schools, which has been pleaded by those who advocate retaining the present compromise in place of adopting the class room system in its entirety.

For instance, the Code contemplates a certificated teacher and a pupil-teacher for sixty children, and the addition of another pupil-teacher for an additional forty children, that is to say, one certificated teacher and two pupil-teachers for 100 children. If these were divided into two classes of 50 each, taught in adjoining rooms with a door of communication, it would probably be quite easy for a clever teacher, spending part of his time with one class and part of his time with the other, and keeping a pupil-teacher in each room, to keep the two class-rooms going throughout the day with success, and without exceeding the amount of teaching power contemplated by the Revised Code. I have, however, now to return to the London Board schools as they are, and resume the description of some of the details which have not yet been touched upon.

I have just referred to sliding partitions as employed to divide a class-room into two smaller ones, with the power of throwing the two together. There can be no doubt that this power is a valuable one, and it is perhaps desirable to put up with some drawbacks of another sort for the sake of securing this advantage, but it is fair to point out that drawbacks exist. There is less perfect separation of the rooms by a means of a sliding partition than when they have a wall between them. No sliding partition is entirely free from danger to the children; and of course the opening and shutting it is, as far as it goes, a disturbance of tranquility.

The older sliding partitions were constructed to rise and fall in grooves like a sash-window; the modern ones are usually made to roll horizontally, being usually hung from a rail above, and also allowed to rest on the floor below. Though sometimes a roller-blind has been suggested for the purpose, it cannot prove efficiently sound-proof. I have employed Mr. Stones' partition, which contains felt enclosed between two thicknesses of board ing, and found it fairly sound-proof; but I do not believe

it to be possible thoroughly to isolate a class-room by means of any sliding partition, and, like all compromises, imperfection attends their adoption. The Americans—whose schools are not yet well known in this country—have, it is understood, employed sliding partitions to a very large extent in many of their public elementary schools.

I have been now speaking of what is usually called a department—that is to say, the boys' portion of the girls' portion of the whole school. The London Board schools have not been mixed schools, except in the case of infants' schools; and each department, for boys or girls, has had a floor to itself. Consequently there are at least two floors, one above the other, in every "graded" school; indeed, the buildings are commonly three stories high, and therefore the necessity for staircases.

The staircase most suited for children's use is one where the open space with which we are familiar by the name of well-hole, is replaced by a brick wall. The steps ought not to be too long, as it is rather desirable not to induce children to go up or down more than two abreast, I believe a length of 4 ft. 6 in. to be ample, and 4 ft. or even 3 ft. 6 in. enough. The steps should not be high; not more than 6 in. rise. There ought not to be any "winder" (the name by which the steps, triangular in plan, which wind round at the turn of most staircases, are called), and in their place there should be landings; lastly, the flights of steps should be short, and the whole ought to receive plenty of light and air. These precautions are taken to reduce to a minimum all chance of serious accident, and to promote the comfort of the children. In a school of any size it is not only desirable to have two staircases, one for boys and one for girls, but it is an excellent plan to arrange the steps so that two sets of stairs may occupy the space of each staircase,—an arrangement which it is not often difficult to carry out. When this is done, each class room may open into the landing of a staircase if wished.

The tall buildings which require such staircases are, no doubt, proper in a large city where land is very dear, where day-light is apt to be much interrupted near the ground, and where a rather purer stratum of air is to be met with in the upper storeys of the building than is to be found below; but where there is sufficient space, free air, and ample light, one storeyed buildings are best. The covered playground, when formed under a lofty building, by carrying it on piers and arches, is often found less desirable and comfortable than a shed built for the purpose. It is more apt to be draughty, and gloomy, and damp; and, when it is adopted, it should be carefully arranged, so that the sun may shine well into it for some considerable part of the day.

How to warm, light, and ventilate a large school-house is, perhaps, the next question which presents itself. The lighting, as has been already observed, should be as far as possible from the left hand, and the windows should be ample. An area of 1 foot of window surface to 80 cubic feet of interior space in the room ought to be sufficient, if the windows are well placed. For infant schools a top light, and for drawing classes a north light high up, are required. The best aspect for a school is a subject that has been debated; some advocating a north as securing the steadiest, purest light, and being from the inconvenience of glare; others preferring a southern aspect, notwithstanding the fact that, occasionally during the summer, blinds are needed, and inconvenience is felt from the sun's direct rays.

I believe there can be little question that the last is the soundest opinion; that sunshiny rooms are far more healthy and far more pleasant than those which the sun never reaches; and that, in a climate so cheerless as

ours, this consideration ought to prevail over every other. The question of gas-lighting does not call for any very special remark; good burners, plain strong fittings, and a place for the lights which will bring them tolerably near the children, are the chief requisites.

The question of heating is, to a great extent, mixed up with artificial ventilation, and both ought to be looked at together. During the summer months afford what is now often called natural ventilation; and an unsparing use of this suffices, if the windows reach to the ceiling, and are capable of being freely opened without draughts, to keep the school and class-rooms fresh and sweet. The best form of window for this purpose I take to be that often known as a hospital-window, fitted with a series of casements, each of which is hinged at the bottom, and opens by its top falling inwards towards the room. The external air is freely admitted by these windows, but its current is directed upwards towards the ceiling, and a very ample volume of air will enter without possible draught. It is quite possible to open and close casements so arranged by an apparatus which is simple and effectual, and which I have had made by Mr. Gibbons, of Wolverhampton, and have applied to two London Board Schools. This I name, because in some hospitals a very costly method of doing the same thing may be seen at work; and committees have, I believe, been deterred from using this, the best form of school window, by the fear of being obliged to go to great expense in providing gearing by means of which to work the casements.

For many months in the year in England, however, it is not comfortable, or indeed safe, to carry on a school with open windows; and during a part, perhaps we may safely say nearly the whole of the same period, heating by some artificial means is necessary. This circumstance offers an inducement, as far as we can, to make the motive power furnished by the heating arrangements effect ventilation also.

In small schools, and in all schools where fuel is cheap, the open fire, which every one can understand, is on the whole the best means of warming, as it combines a powerful ventilating agency in its chimney, with direct radiated heat.

It is very desirable, however, to combine an inlet for fresh, warm air with the open fire in the grate. Many contrivances for doing this are in use, and it is only necessary here to say that they almost all proceed on this principle of utilising the otherwise waste heat radiated from the back and sides of an ordinary grate to warm a volume of fresh air, which is poured into the room. Outlets and flues (adjoining the chimney smoke flue if possible) should also be provided, in order to carry off readily a portion of the vitiated air; and where these inlets and outlets are at all well-proportioned to the size of the school or class-room to which they are connected, and are disposed with judgment, they will supply a very considerable and useful amount of constant, insensible ventilation.

In large schools it must be held to be the more economical and more scientific course to use a heating apparatus for the whole building. The cheapest apparatus, both as to original cost, and probably also as to the amount of heat obtained from a definite consumption of fuel, will be hot-water pipes carried into the school-rooms and class-rooms, and exposed in the rooms. A large amount of heat is directly radiated from the heated iron surface, and a large amount is also distributed by the circulation of the air of the room, which becomes warmed by contact with the pipes, rises, and is replaced by another portion of cool air. But this circulation in no way assists ventilation; the pipes themselves are an obstacle, sometimes a dangerous one, to free circulation, and the radiated heat

is often extreme; while, if the system is such as to permit the surface of the pipes to be heated above a very moderate temperature (and this is the case in all systems which I have had an opportunity of examining, where the pipes are of small bore and the circulation is at high pressure), the air becomes desiccated (and I believe deoxygenized), and general discomfort ensues, such as militates seriously against the efficiency of the whole school.

My belief is, that a system in which the fresh external air is heated within a chamber in the basement by contact not with a furnace, but with a mass of low-pressure cast-iron hot-water pipes, or flanged vessels, and is then conveyed through flues or channels to each room of the building, is the best system of warming for a large school; corresponding flues or other suitable outlets being provided for the outgoing current, for which, of course, provision must be made in the original construction of the building. It is not cheap; but, if efficiently done, as it has been for me by Messrs. Price in one instance, and Mr. Boyd in another, it provides at one and the same time warmth and fresh air.

Such buildings as I have now described are the appropriate and convenient home for a school in which the three departments of infants, girls, and boys are distinct, in which, in either boys' or girls' school, there are a head teacher, a certain number of certificated under-teachers, and a certain number of pupil-teachers. This, as I have already mentioned, is not the system in the most advanced schools on the continent of Europe. In Switzerland, Austria, and notably in Prussia, schools are arranged so that every class shall have its own class-room. The building contains class-rooms seating ordinarily about sixty each, connected together by suitable corridors and means of approach, and a large assembling-room called the *aula* or hall, not usually large enough to receive all the pupils at one time, and not used as a school-room in the sense in which we employ the term at all. The whole forms a very compact square block of buildings, admirable as a rule in every particular except its ventilation, which is generally defective.

It was desired, when the School Board for London commenced work, to try the experiment of building a school on this plan; and it eventually fell to my lot to design and carry out for the Board the school which they built on the class-room system, or, as it is often called, the Prussian system, at Jonson street, Stepney. This school originally designed for 1,000 children, was subsequently re-planned on a still larger scale, and as built affords accommodation for 1,675 children, of whom 575 are infants. With regard to the infants' schools, which occupy the lowest floor, no special remark is necessary, except that it is divided into two equal and similar schools.

On the first and second floors occur the departments for boys and girls respectively. Each school possesses eight class-rooms, intended for sixty children each, and these rooms are grouped round a large hall, measuring 40 feet by 75, of which they occupy one side and the two ends. In this hall is an end gallery, and it is intended that both in the hall and on the gallery a class should be taught. The original cost of this building was extremely moderate, comparing it with the cost of many Board schools in London and elsewhere, not exceeding £7.12s. per child; and though it would not have been quite so economical, if built for a much smaller number of children, still a school of the same general plan need never be a costly building.

This building varies to a certain extent from the Prussian model. The variations were partly due to the determination to obtain a very large hall, in which all the boys and girls could be assembled at one time, and partly

to my desire to secure through ventilation. The ordinary Prussian school is very solid compact block, and often has a central corridor, and so there is really no chance of ventilating the class-rooms completely. At Jonson street I suppressed the corridor, making the class-rooms open direct into the hall, and I introduced windows at the sides of all such class-rooms as are corner rooms in the building. Elsewhere I introduced large windows in the wall, separating the class-room from the hall, treated the latter as a magazine of fresh air, and by this means secured the through ventilation of every class-room. In winter the warming by warm fresh air, accompanied by a system for the extradition of vitiated air, keeps the class-room sweet and airy.

I regret extremely that a second school of the same general character, but smaller in size, which it had been intended to erect from Mr. Robson's designs, was abandoned. It would have an interesting experiment, and extremely likely to prove successful. The plans of this school, as well as those of my Jonson street one, are engraved in Mr. Robson's excellent book on "School Architecture."

This class of school, though the time has not yet fully come for it to be built in this country, is the elementary school of the future. It, or something very like it, is the middle-class school of the present day, or, to speak more correctly, the leading principle. A class-room for every class, and a general room for assembly, is the leading principle upon which middle-class schools are being designed, built, and conducted. I may refer to the Cowper street Middle-class School, the magnificent new Merchant Taylors' School, and the schools proposed to be built by the Grocers' Company, as examples of the class-room system. As time goes on, there can be little doubt that elementary schools will conform to this model. Already, taking one of Lancaster's schools of seventy years ago as at one extreme of the scale, and a complete Prussian school as the other, the planning of English school buildings has advanced at least half-way. By slow degrees a greater and greater amount of isolation for the classes has been introduced.

First came the breaking up of Lancaster's Macedonian phalanx into classes, and grouping them about a large room in full view of each other; next the placing those classes all on one side of the school-room, with curtains separating them; then came a single class-room; then two or three each to open solely out of the school-room; and now one-half the school receives class-room accommodation, and the class-rooms are made so far independent of the school-room that the pupils taught in them have distinct means of entrance and exit.

These steps are all in one direction, and though at the present moment members of School Boards may be unable to see their way further, there can be no manner of doubt that when next a change is made it will be made in the direction of more class-rooms; it seems, therefore, matter for some regret that, among so many elementary schools now being erected in Great Britain, so few of these should be adapted to the most advanced mode of education practised in Europe.

Of the fittings required by a school, the benches and desks are by far most important, not only because they are wanted in large numbers, but because they directly influence the success or failure of instruction and discipline, and their size and arrangement dictate the dimensions and shape of the school-rooms and class-rooms. The desk is required to accommodate the book for reading, the slate for cyphering, the copy-book for writing, and perhaps the music-book for singing; and it must provide storage for books not in use; its height, slope, shape, and distance from the bench must be regulated accordingly.

I will dismiss at once those hybrid contrivances in which the unfortunate desk is also required to form part of a tea-table, or to disappear altogether and become the back of a church bench, believing that every such complication adds to the difficulty of making it efficiently perform its legitimate functions. The bench ought to be exactly at the right height for the pupil, both as regards its height from the floor, its height below the desk, and its distance from the front of the desk, and it ought to be of the right shape for easy sitting. The length of the desk and bench, and the spacing generally, are to be regulated by the desirability of gaining easy access to each child's work.

In many old schools these conditions are barbarously violated, and you have only to watch the distorted attitudes of the pupils at work to be convinced that they are getting no good from sitting in narrow benches too far from the desks, without backs, and with the desks too far off and probably too high. Mr. Liebreich, whose paper on the subject of school fittings attracted a good deal of attention when read in this room, demonstrated the necessity of closely studying the requirements of the pupil, and before him and after, many persons of experience have devoted themselves to the same subject. The old desks sanctioned by the Committee of Council were in long lengths, and confusion necessarily arose when a child near the centre had to enter or leave; they were also not well adapted to facilitate the necessary access which the teacher ought to have to every scholar, and they were in other respects imperfect.

Many improvements have been lately brought forward. The one adopted in London by the London School Board is what is known as a dual desk—that is to say, it is a desk and bench only, enough for two children; the desks are forty inches long, are placed five deep, and between every two sets of desks a gangway is left of sixteen inches wide, which gives access both for teachers and children. The seat inclines very slightly, and has a back rail at a moderate height, rather higher for girls than for boys, and a foot-board. An essential feature, and one which has been attacked by some school managers and by many school fitting manufacturer as open to objection, is a rising flap to the desk. When this flap is down, the sloping part of the desk is a foot-board, and its front edge is exactly over the front edge or seat-board—a position very convenient for writing, but not allowing of the pupil to stand up in his place. The front five inches is hinged, and when turned up leaves ample space for the pupil to stand, and also itself forms a good desk for music. This contrivance permits great economy of space, and when the children are drilled to the use of it, seems to give satisfaction; but it has been objected to it that it is a complication, and therefore liable to break—that it is possible for children to injure themselves in it—and that, if one pupil happens to raise the flap before the other is ready, books, &c. may be thrown down. This is exactly one of the questions which experience will decide; and as there is now a very large amount of experience accumulated, the point ought to be capable of a solution in this room to-night. Below the desk is a book-shelf, and there is in the back of the desk an ink well and an opening for a slate to each pupil. The standards are of iron. This fitting is extremely complete, and on a level with anything in use elsewhere, except perhaps in the best German schools; it is also expensive, as might be expected, from its elaboration. In Sweden and in America each child has a separate desk and seat; and in Sweden the difficulty about obtaining standing space with a seat and desk in proper relative positions for writing is met by making a flap-seat in place of a flap-desk.

When economy is of importance, it would be worth

while to try whether the principal features of these desks and benches could not be retained without iron standards. Stout wood is very durable and very strong; and plain fittings entirely of wood, could, I think, be designed and constructed at somewhat less cost than the mixture of materials now in fashion necessitates. At least I knew that some years ago, when iron was cheaper than it now is, I personally tried the experiment, and with success.

The other fittings of a school, while, of course, they require care, are not of the same vital importance as the benches and desks, and need not, I think, be dwelt upon here. Nor shall I attempt to do more than name, and that in the most cursory way, some of the miscellaneous matter of which the school architect ought not to lose sight. It is indispensable to a well-ordered school for it to have ample water supply and efficient drainage; proper lavatories; sufficient cloak-rooms and cap-rooms; adequate conveniences in a detached building, approached under cover, and of simple construction; a covered playground to each department; a supply of pure drinking water for the children; a class-room so lighted as to suit a drawing-class; in some girls' schools a class-room of large size as a needle-work room; one or more teachers' rooms; accommodation for a resident care-taker, or sometimes a teacher's residence; storage for fuel; and sometimes a committee-room ought also to be provided in every complete school. There should, if possible, be no corridors; and where they occur, they must be roomy, direct, and well lighted. A playground of due size is also necessary for each department, and there should be provision for lighting it on dark evenings if there be gas in the building. If possible, the entrance for boys should be in a different street from that for girls and infants, at any rate in should be distinct.

Nothing which can get out of order should be introduced if it can possibly be avoided. Everything should be of the best and strongest, for it will have to stand rough usage. Nothing through which an accident can occur should be introduced, and if it is found that by mischance any place where a child can fall through, or fall over, or any dangerous spikes or open water cisterns are within reach of an adventurous lad, they should be at once removed at any cost, or completely protected. Nothing by which a child can be hurt should be knowingly permitted, or if discovered allowed to remain; no dark corners or places where fresh air cannot come should on any account be tolerated; and no pains should be spared to make the smallest details of the building and of its furniture as appropriate as possible to the purposes of the school—and here, let me say, the managers, the teachers, and the architect should work together. Many minor matters are best understood by those who have the practical working of a school, and if it were possible, as a new school-house approaches completion, to secure the principal teachers, and to give such finishing touches to the arrangements as would suit their methods of working, their can be no doubt that after-expense would often be saved, and increased satisfaction would be felt by the managers. Lastly, but by no means least, all these matters should be thought out in good time, and at sufficient leisure, so that they may be introduced into the original contract for the building, and heavy additional cost which always attends modifications made during progress may be avoided.

In bringing these remarks to a close, it is, I feel, necessary to apologise for the amount of dry detail introduced. Every practical undertaking, like the planning, carrying out, and fitting up of a building, depends for fully half of its success upon an incessant attention to minute detail. It is quite true that the general plan, the design grasped as a whole, and the skill with which the

leading divisions of the building are adapted to their purpose, is of great importance. But it is equally true that the best design in the world, if carried out without careful attention to details, will be found full of small defects when tried by working experience; and consequently, that even in attempting to give a comprehensive and general view of such a subject as a building and its fittings, I have been unable to avoid much detail, for in no other way could I have rendered even the slight sketch of school buildings and fittings which I have attempted to lay before you trustworthy as far as it went.

It has been my especial desire to embrace this opportunity of advocating, before an audience capable of forming a judgment upon them, the claims of the class-room system. So many classes so many rooms, is the rule in many schools in Scotland, and Scotland is ahead of England as to education. The same thing is the universal rule in Prussia, and Prussia also is ahead of England. It cannot be denied that absent from the noise and the distractions of a large common school-room the class can better concentrate its attention upon its work, and its teacher can better give his energies to what he has to do. It seems certain that the same teacher would do better work in a class-room than in a general school room, not only from the fact of being undisturbed, but also from being more thrown upon his own responsibility. He has, in the general room, the head master to fall back upon in any difficulty; while shut up with his class in their own room, he has far more need of self-reliance and firmness, and will certainly be a better man. The system seems undoubtedly destined to reach elementary schools in time; but if it really be the best system, it appears a matter for regret that at the present moment, when schools are being established by the hundred, and millions are being laid out upon costly and permanent buildings, we should rest content with a compromise, and should not, some of us at least, boldly decide to adopt the very best method that we can in our school management, and should not construct our buildings in such a manner as to be capable of being worked on that method.—*Educational Times*.

Boston Kindergartens.

LOUISE CHANDLER MOULTON.

"Kindergarten, or no kindergarten" is a question likely to be much discussed, not only by mammas, anxious to know how best to rear and tend their human flowers, but by school commissioners, and those in authority generally. As Boston is the headquarters of the kindergarten movement in America, perhaps some account of the theory and practice here will not be uninteresting. In my researches on this subject I went first to that dear old patron saint of the movement—herself a wise, blessed, grown-up child—Elizabeth Peabody.

"There are just four true kindergartens in Boston," she said; "all the rest are spurious." I have learned since that she ought to have included two more, recently established under the auspices of the North-End Mission, with trained teachers, and conforming to the ideas of Fröbel as far as possible. Miss Peabody seemed to regard Miss Garland's, in Chestnut street, as rather the model establishment; so I spent there one entire forenoon this week, in order to see, as thoroughly as might be, what it is to be a human flower in a child-garden. Miss Garland's hours are from 9.30 a. m. to 12.30 p. m. Her school year is thirty-six weeks in duration, and her terms are

eighty dollars per annum. To have a longer school-year, she said, was of no use, because such families as sent their children to her never returned to town before October, and some of them had even already gone into the country. Three hours a day she found quite long enough to keep her little people systematically busy; for busy they are every moment of the time.

She takes children of from three to seven. She would like to have them the entire four years. It is a fundamental theory of the kindergarten that no child should ever begin to learn to read until it is seven years old; and the progress of some children taught on this system, when once they began to study, has been truly marvelous. Miss Garland has an assistant, and a second school room, where a few of those who have been under her care until they were seven, are now devoting a small portion of every morning to learning to read, and they are so trained in habits of minute observation and close attention that they seem to learn almost at sight. Her maximum number is twenty-two; but she admits so many only because among such little ones there is seldom a day when all would be present. One has a cold, another the measles, or another an anxious grandmother who thinks the weather is too inclement; so that not more than sixteen or eighteen are likely to be in school at once, and that is as large a number as the true kindergarten ought to contain.

I wish I could make a picture for you of this room and the little people in it. There are pictures on the walls, such as Cheney's crayon of the Sistine Madonna; on brackets are graceful busts; bouquets are in pretty vases; but, above all, there is a wealth of green things growing, potted plants in large variety and in a very thrifty condition. This idea of growing plants, you must understand, is one of Fröbel's essentials. It is good for the body, he thinks, to tend them; it is good for the soul to love and watch them. Each child has one or more. His plant is as much his own as his cap or his mittens. He waters it—he picks off the dead leaves—he turns it toward the sun—he is proud of it beyond measure. The children who are present each day are allowed, as a favor to tend the plants of the absent; and they do this faithfully and with great delight.

Imagine, in this picture-adorned, blossoming room, a dozen little tots, more or less—girls and boys being about equally represented. Fancy them seated in little chairs, so as not to tire their tiny legs, before long, low tables, just about as high as the seat of a grown-up person's chair, made of light, polished wood, divided by black lines into square inches, by which the eyes of the children presently become accustomed to measure objects. Here they sit for half an hour, busy, perhaps at building with blocks, perhaps at modeling in clay, perhaps at folding paper, or drawing, or embroidering on cards; for no John or Richard who has been trained in a kindergarten will be necessarily dependent on his wife's caprice as regards his buttons. This work goes on far half an hour, and then there is half an hour of play. But, first, I must tell you about the "occupation," as they call it.

Building with blocks sounds like mere fun, doesn't it? but, really, it exercises these little minds very actively. They were given, when I was there, a cube, which in Fröbel's list of "Gifts" is numbered the fourth. It is composed of eight wooden oblongs, two inches in length, an inch wide, and half an inch thick. These little oblongs are shaped like bricks, you perceive, and with them the children are instructed to build. Each one must have his own idea, and plenty of room is thus given for invention. One built a bridge, with steps leading upon to it, suggested by the one in the Public Garden. Another made a summer-house and explained his notion of its construc-

tion. Another made what he called an engine, with the gate to shut when the bell rings, and the sign-board over it. He had a spare oblong, and he set it up on end and said it was the man to tend the gate. Another little fellow, full of fun and brightness, made a school-house and set a solitary oblong in front of the door. "Who is that?" asked Miss Garland. "That is Elise, coming all alone, as she did this morning," he said, laughing. Elise was a small maiden, with bright eyes and many ruffles, who was usually escorted by a nurse, but who had surprised them that morning, by coming, with the utmost dignity, quite alone.

After this half-hour's "occupation" was over, there came half an hour of play. The plays are set to music, and are the most admirable system of gymnastics imaginable. Let no one aspire to teach a kindergarten who cannot sing, at least tolerably, for amusement is all accompanied by singing. They play mostly ring plays, so contrived as thoroughly to exercise the muscles, to teach grace of motion, and to prepare the little folks for future dancing. After half an hour's play comes another "occupation." Perhaps it is drawing. For this purpose they have peculiar slates, grooved into little squares a quarter of an inch each way. This aids them to be accurate in their lines. As they go on the slates are changed, the grooves becoming less and less deep, until at last they can draw as accurately on plain slates as they could at first on the grooved ones. Or perhaps they weave paper, choosing their own combinations of color. Or they model; and one little boy had shaped out of clay a surprisingly good turtle. Their leaf impressions in clay were extremely delicate and pretty. All the time their attention is alert; their habits of close and accurate observation are forming, and they are so interested in what is going on as to know no weariness. They wait on themselves, and put away all their implements as soon as they have finished using them, with a careful orderliness which is in itself an excellent training for the future man or woman. They learn to be independent and self-helpful.

There is only one public kindergarten at present in Boston, but there is a wide-spread desire that there should be others—enough to accommodate the whole city full of little folks. The one objection is the price. It is the most expensive of public schools, because, while one teacher can and does ordinarily attend to the instruction of fifty scholars or more, the utmost number which can be taught with advantage in a single kindergarten is twenty-four. Miss Garland, in her private school, would not admit so large a number as this; but it would be the maximum number of the public kindergarten. The single public one already established is at the corner of Allston and Somerset street, under the charge of Miss Symonds, a teacher trained by Miss Garland. The outlay for the necessary working apparatus for the first year is not less than \$150, and the city hesitates to pay a teacher a full teacher's wages to instruct two dozen babies, and to add \$150 more to buy them scientific toys. But the kindergarten advocates trust to this one experiment to prove their system so useful, and, indeed, so necessary, that the public cannot afford to do without it.

It is curious to notice the difference in condition of the "human flowers," as Fröbel loves to call them, in the different schools already in progress in Boston. Miss Garland has under her care the pot-house blossoms—the delicate little fairies who are brought to her by their maids or their coachmen, and who are clad in purple and fine linen. The public kindergarten contains good, hardy, native flowers, corresponding with those which grow out of doors in our gardens, fed by wholesome rain and sun and dew. And the two kindergartens which

the North-End Mission has just added to its already noble work, are they not full of weeds—poor, little, vagabond, wayside thistles? Miss Garland says her great difficulty is to interest her pampered little ones—used to French dolls and unlimited bon bons—in the simple pleasures of the kindergarten. They are accustomed to so much luxury at home that the pictures and flowers and little ornaments which would be a vision of impossible loveliness to some poverty-stricken child, seem to them, at first, trivial and of small account. But, as soon as they have tasted the pleasures of observation and invention, she has no more trouble. Yet she half seemed to envy the teachers of children who were not the curled darlings of fortune. "It would be so lovely," she said, "to give them their first glimpses of beauty and order—to open to them the doors of a new world." As to the mission schools, one of them is taught by a Roman Catholic, the other by a Protestant; so that for little wayfarers of either faith there is congenial welcome.

One cannot go to a kindergarten without becoming enthusiastic about the system. You see the little creatures, so quick, so observant, so inventive, and, above all, so bright and so happy. "How do you punished them?" I asked; "for, of course, being human children, they are naughty sometimes." "They seldom need anything more than the mildest reproof," was the answer; "but when they do, it's quite sufficient to move the offender's chair away from the others, and give him a little sense of isolation."

There will be no lack of trained teachers for this system, for every year Miss Garland has a class of young ladies in the afternoons. She carefully instructs them in her theory and practice; allows them, by turns, to assist in the exercises of her own school; and, at the end of a year, she will have abundantly fitted them for their work, provided always that nature has been beforehand with her in giving them a mental and spiritual adaptation to receive her instructions. For let no one think that to teach in a kindergarten is a simple matter, requiring little culture and less genius. I know of no more exacting occupation. Infinite tact, infinite sweetness, infinite patience, are a few of the requisitions. Wordsworth's perfect woman, nobly planned, would be none too good for it. But, given the teacher at once wise and zealous, and the parent who understands that to spell words of three letters is not of the only or the most important knowledge possible to an infant human being, and we can certainly, by the system of Fræbel, make our children thoughtful, reasoning, inventive, and orderly, almost from their cradles; and, above all, we can so quicken and awaken their perceptions as to render them capable of using, to the best advantage, whatever opportunities the future may offer them.

The general interest in this system is rapidly increasing. Four or five other visitors were at Miss Garland's when I was there, among them a gentleman and his wife from Minnesota, who wished to make the system useful on the frontier. A young lady came in—one of Miss Garland's class of teachers who graduated last week—and it appeared that she had already been engaged by a number of wealthy families to keep a summer kindergarten at Beverly Farms, which was to combine with the regular system all out-of-door delights of flowers and birds and sea and sky.

To the almost universal use of this system, there is, as I said, the one sole objection—its expensiveness. People must very thoroughly understand the importance of early training in order to be willing to pay so much to educate their babies. The state not only hesitates before one teacher and \$150 worth of apparatus for every two dozen scholars, but the parents stop to consider

at \$80 a year for a wee object just out of its cradle; but, meantime, enough are being taught to show the worth of the system; and the few who have both the sense to perceive its advantages and the money to procure them, are likely to see their reward in the educated perceptions of their very young children.—*New York Tribune*.

Canon Barry on Education.

Very recently, Canon Barry delivered the inaugural address for the winter session to the Evening Class Department of King's College. After briefly referring to the objects and curriculum of the classes, the Rev. Canon proceeded to give a general view of the present position and future prospects of education in this country, considering the subject under three aspects:—1, Hopeful symptoms of energy and progress in education in England; 2, Effects produced by these; 3, Chief hindrances to educational progress, and how they ought to be and must be removed. Among the hopeful signs, we find first, a far clearer conception than was customary, of what education really means. A second mark of progress is that people are learning to take a larger view of education; they are coming to see that education is of two kinds—*liberal*, the education of man as man irrespective of his walk of life, and *technical*—the recognition of man in his profession, or, as we more properly say, his vocation, and the endeavour to bring out his powers with a view to professional excellence. Both are necessary, and choice must be made between narrowness and superficiality. Generally, technical education will take care of itself, owing to necessity as well as to habit. Hence in these days of individual activity and competition, technical education is acquiring greatly increased attention; the necessities of the times are pressing it on. But liberal education ought not to be discouraged. It gives width and breadth of character, and power of sympathy with and understanding of others; and this is of profound importance to the body politic now that there is a tendency to separation of classes in this country. Liberal education also keeps a man from being a professional drudge, and raises the mind, heart, and affections. A third hopeful sign is that greater honour is paid and greater power given to education as such. Inequality is as much a law of nature as equality. What are the powers which lead in society? First we find *social rank*, which has played a most important part in history, though it is at the present day diminishing. There is secondly, *money*, concentrated power gaining its strength partly from the decay of the power of social rank; the power of money is increasing. Lastly is the power of *intellect and character*, or, as we may put it collectively, of the *mind* (of the two "character" in a thousand times greater than "intellect"). This is increasing, and does away with the fear of a plutocracy. Again, in public opinion greater respect is paid to education now. So also the dignity of the office of teaching is greater, though it has not yet reached its highest place; but from the highest professor to the lowest pupil teacher in an elementary school, the office of the teacher commands greater respect and influence. People are also beginning to think that the education of the country should be treated as a whole, and each class of school is now graded with a view to the passing of children upwards from the lowest to the highest. Our old educational institutions are the only places where boys and men meet on equal terms except that which superiority of attainment gives, and education has a levelling and uniting power.

To turn to the consequences of this increased energy,

we find a most wonderful development in the lowest stratum—elementary education. The extent and importance of this division may be gathered from the fact that it includes four fifths of the children of the country (taking the estimate of the London School Board that it has to do with four-fifths of the child population of London). Much has been done, but the state of elementary education is still low compared with the most highly educated nations. The causes of this have been—poverty in educational machinery, and irregularity of attendance. These hindrances to elementary education are in rapid progress of being removed, and before two years are over there will be not one nook or corner in England where the appliances of education are deficient. This is the result of the recent Education Act. The hindrance of irregularity of attendance is more difficult, but it is being to some degree, and will be to a great degree though not entirely removed. In all this they are endeavouring to preserve the old lines of education—intellectual, physical, moral, and religious—and the country has pronounced strongly and emphatically in favour of the retention of the religious element without which no system of education can be complete. Progress in the highest education is almost as great. Look at our old universities; they are using their materials with an energy and activity marvellous to those who know them thirty or forty years ago. They are aiming at that which gave the name “university”—“*universa scientia*” Where one is not satisfied is in the intermediate links between the universities and elementary schools. Some thing has been done by our public schools, but much remains; the chief hindrances being from the evils of the class from which they draw their boys. The public schools should be increased in number, and the present schools improved, encouraged, and modified. The commission for that purpose came to a tragical end, but it is impossible to stop the necessity for it, though opinions may differ as to the way to set about it. Great attention should be paid to this unsatisfactory condition of middle-class education. The great hindrances to elementary education are poverty and pauperism, the latter, which may be termed wilful poverty, being the worst. The experience of the London School Board proves that all other hindrances are light. The wages of the working classes are largely increasing; they are gaining more leisure and rest—and it is a matter for rejoicing that it is so—and more political power is passing into their hands. With all these, educational hindrances ought to diminish; whether they will, depends upon whether the moral hindrances—drunkenness, wastefulness, and idleness—will diminish. The hindrances to education among the middle class are (1) over-pressure of work, beginning too early, earlier than any of the continental nations, arising from the strain of competition, and this again from the striving after material wealth; and (2) from the dependence almost entirely on practice without science. Here we want change of public opinion. With regard to the upper classes. Eton and Harrow have often been found fault with because the boys do not work, but that is not the fault of the schools nor of the teachers; the atmosphere of the homes from which the boys come is not favourable to work, owing to the enervating influence of the luxury of the times; they feel that there is no necessity to work; none work but those of the highest intellect, and those who are driven to it by necessity. There is also the demon of athleticism which is working so much mischief in our educational institutions. These are rather negative hindrances than positive powers. Hence there is the greater hope for the educational future of England. There is the greater hope because of the wonderful co-operation of individuals acting with the

corporate power of the State, and of the religious element, always foremost in education, acting with the temporal power of the State. There is a class of politicians who think the religious element harmful to education, but if so, all history must be read backwards.—*The Schoolmaster.*

EDUCATIONAL.

The Ladies' Educational Association.

When this Society commenced its useful work, it was confidently predicted by not a few that its existence would be short and its success small: This has not been verified by the result. It has now carried on its work quietly and judiciously for four years, and it may be safely affirmed with increasing usefulness. Many young ladies who had left school, many other in the higher classes of the schools in the city, and many of those engaged in the work of teaching in the public and private schools, owe to it a lasting debt of gratitude for the means of culture which, without its aid, they could not have enjoyed; and if we are not mistaken, a higher and more intellectual tone has been introduced into the conversation and social intercourse of many of the circles and coteries that make up our city life.

In the term which closed at Christmas, the subject of French literature was ably discussed by the Rev. M. Lafleur, and in his report, presented to the Committee, the lecturer expresses himself as highly satisfied with the work of the class, and with the progress of those who presented themselves for examination. The examination questions cover a wide field, and must have required knowledge and critical acumen to answer them well.

Dr. Johnson, of McGill University, in the same term treated the subject of light, and the class had the benefit not only of the knowledge and eminent gifts for teaching of the lecturer, but of the admirable optical apparatus of the University, which, thanks to the liberal subscriptions made for the purpose a few years ago by some of our leading citizens, is at this moment perhaps equal to any on this continent in its appliances for exhibiting all the newer experiments on the subject. The ladies had thus rare opportunities for acquiring the knowledge of a branch of science at once beautiful and difficult. The class was large, and twenty-five students came up for the examinations. The printed paper was both long and stiff, but the examiner reports the results as highly satisfactory—twenty-two of the candidates being entitled to certificates, and eight being placed in the first class.

The results of the past term are thus very gratifying, and more especially so in the indications which they give of the value of the work in an educational point of view. It is only to be regretted that a larger proportion of the class does not come up for examination; but as this must necessarily be voluntary, and the preparation for the examinations involves much work, only a minority can at present be expected to present themselves. It is evident, however, that an improvement is taking place in this respect, and more especially that ladies are beginning to attach the proper degree of importance to the certificate which they obtain on passing the examinations.

The courses of lectures which have just commenced, on the truly *vital* subject of hygiene, by Dr. Roddick, and, on English literature by Dr. Kelly, are likely to be still more largely attended; and no lady who can by any means spare the time should fail to attend one or both of the courses. Dr. Roddick is a master of the subject of hygiene, and perhaps nothing could tend toward the improvement of the public health more powerfully than an adequate acquaintance, on the part of ladies, with its laws. Dr. Kelly is a specialist and enthusiast in English literature, and well acquainted with the best methods of giving instruction in the subject, which is one that commends itself specially to the attention of every educated woman; and we have reason to believe that the lecturer will venture to treat it in that critical and scientific way which alone can lay a good groundwork for its acquisition.

One further remark it may be well to make here. The Association is entirely supported by the voluntary subscriptions of its members and the fees of students, and the former should not be limited to those who can directly avail themselves of its

benefits. Every lady, whether she can attend the lectures or not, should be proud to be a member of the Association, and in that capacity a patron and supporter of the higher education of women in this country. It is, however, surely to be expected that in process of time permanent endowments will be given, which may enable the work of the Association to assume a more stable character, and to be less dependent on annual contributions. It is well to help those who show themselves able to help themselves, and we cannot imagine any body more likely to administer such endowments well than the ladies who have so admirably conducted this Association thus far.

(Montreal Gazette.)

McGill College.

CHRISTMAS EXAMINATIONS, 1874.

On Saturday, the 19th of December, the Christmas Examinations of McGill College were concluded, but the results were not known until the 29th. Below we publish the list of those who have passed.

Some of the students, as may be seen below, passed exceedingly creditable examination. Noticeable among these are Sproul (1st year Science), Chapman (middle year Science), Ross (1st year Arts), W. B. Dawson (senior year Science), and Lafleur (2nd year Arts).

Of all the students, however, Sproul is the only one who stands first in the first class of his year in every subject in which he was examined, which is certainly a very high position for any scholar to take considering the large number with whom he had to compete.

Faculty of Arts.—Greek.—First year Class I. Ross (Jas.), McFarlane; Dawson (Rankine) and McLaren and Thornton, equal. Class II. Donald and Ritchie (C. W.) and Taylor and Powell, equal; McFayden and Rose (Peter) and Torrance, equal; McKeen, McKillop Class III. McCrae; Lyman (A. C.) and Lynn, equal; Evans, McKay; McLean and Guerin, equal; Shearer and Sweeney, equal.

Second year. Class I. Lafleur, Gould, Newnham, Graham (J. H.). Class II. Pedley (C. S.); Anderson and Warriner, equal; Scott, McGibbon, Robertson, Amaron (Calvin E.). Class III. Russell; Chubb and Forneret and McLeod, equal; Walker.

Third year. Class I. Crothers, McGoun; Cox and Lyman (H. H.), equal. Class II. Watson, Rexford, Malcolm, Graham (Jno.), Duffy. Class III. Matheson Gray.

Fourth year. (No examination).

Latin—First year. Class I. Donald, Ross (Jas.), MacFarlane, Ritchie (C. W.), Taylor. Class II. Thornton; McKeen and Lawford, equal; Dawson (Rankine), McCrae, McLaren, Lyman (C. A.). Class III. Guerin and Powell, equal; McKillop; Ross (Peter) and McFayden and Torrance, equal; Sweeney, Lynn, McCay, Evans, McLean.

Second year. Class I. Lafleur; Gould and Newnham, equal; Graham (J. H.) and Pedley (C. S.), equal. Class II. Anderson, Warriner, Scott; McGibbon and Robertson, equal; Amaron (C. E.) and Forneret and Russell, equal. Class III. Chubb, Walker, McLeod.

Third year. Class I. Crothers; McGoun and Watson, equal; Rexford; Cox and Lyman, equal. Class II. Duffy, Graham (Jno.). Class III. Matheson and Gray, equal; Malcolm.

Fourth year. (No examination).

Elementary Psychology.—Second year. Class I. Warriner, Pedley (C. S.), Scott, Gould, Lafleur, Russell, Robertson, Amaron, McGibbon, Newnham. Class II. Walker, Forneret. Class III. Graham and McLeod, equal; McLennan, Anderson, McPhee, McDougall, Chubb.

Moral Philosophy.—Third year. Class I. Rexford, McGoun; Lyman (H. H.) and Crothers, equal. Class II. Duffy, Cox. Class III. Matheson, Hughes, Gray.

Mental Philosophy.—Fourth year. Class I. Stuart, McKibbin, Rutledge, Siloux. Class II. Knox, Cossar. Class III. Millyard, Whiteside.

English language and literature.—First year. Class I. Ross (James), Dawson (R) and Donald, equal; Lawford, McFayden, McLaren, McCrea. Class II. Powell, McKeen; Ross (Peter), Ritchie (C. W.) and McKay, equal; Thornton, Evans, Lyman (A. C.) Torrance, Lynn, McLean, McKibbin (R.), Shearer. Class III. McFarlane, McKillop, Guerin, McIntosh, Imrie, Sweeney.

Third year. Class I. Rexford, McGoun. Class II. Crothers, Matheson, Graham, Duffy, Watson. Class III. None.

French.—First year. Class I. Ross (Jas.), Donald, Powell; Dawson (R) and Guerin, equal. Class II. Ritchie (C. W.), McKillop, Lawford, Evans, Thornton, Taylor, Torrance, MacFarlane, McLaren. Class III. McKibbin, Lyman (A. C.) and Lynn, equal; McKeen, Sweeney, Imrie.

Second year. Class I. Lafleur, Amaron, Gould, Graham (J. H.). Class II. Forneret. Class III. Chubb, McGibbon, Robertson.

Third year. Class I. McGoun. Class II. Lyman, (H. H.) Class III. Graham (John), Duffy.

German.—Third year. Class I. Watson.

Second year. (Senior Division.) Class I. Lafleur. (Junior Division.) Class II. Chubb.

First year. Class I. Lawford. Class II. Evans. Class III. Guerin.

Hebrew.—Junior Class. Ross, McKay, McCrae, Boudreau; McKillop and Shearer, equal; Lynn, Newnham, McFadyen, Pedley (C. S.), McLean, Sweeney, McIntosh.

Senior Class. Warriner, Scott, McLeod, Russel, Anderson.

Mathematics.—First year. Class I. McFayden, Shearer; Dawson (R.) and Koss (Peter), equal; Donald; Lawford and McCrae and Torrance (F.), equal. Class III. Imrie, McKay; MacFarlane and McKillop and Ross (James), equal; Powell, Thornton, Lyman (A. C.), McKibbin (R), Guerin.

Second year. Class I. Scott, Graham (J. H.), Lafleur, Newnham. Class II. Gould, Warriner. Class III. Pedley (C. S.) Russell, Ewing, Walker, Robertson, Forneret, Anderson, McGibbon.

Mathematical physics.—Tird year. Class I. Rexford, Lyman (H. H.), Crothers (R. A.). Class II. None. Class III. McGoun and Watson, equal; Cox, Duffy, Graham (J.), Gray.

Fourth year. Class I. Chandler. Class II. None. Class III. McKibbin (W. M.), Stewart.

Experimental physics.—Third year. Class I. Lyman (H. H.) and Rexford, equal; Duffy, Crothers; Graham and Ewing, equal; McGoun. Class II. Watson. Class III. Gray, Joseph, Matheson

Fourth year. Class I. Chandler, Stuart. Class II. None. Class III. Ritchie (W. F.).

Anne Molson mathematical prize.—Candler, (G. H.),

Natural Science.—Fourth year. Geology. Class I. McKibbin (W. M.), Silcox. Class II. Whiteside, Routeledge, McLennan (D.).

Third year. Zoology. Class I. Crothers; Lyman (H. H.) and McGoun, equal. Class II. Cox, Ewing, Watson. Class III. Matheson, Duffy, Hughes, Graham (Jno.), Malcolm, McLennan (D.).

Second year. Botany. Class I. Lafleur and Scott, equal; Warriner, Gould, Newnham, Robertson, Amaron. Class II. McLeod, Cossar, Pedley (C. S.), Walker, Forneret, Anderson, Russell, Chubb. Class III. McPhee, Knowles, McGibbon, McLennan, Graham (J. H.).

Chemistry.—First year. Class I. Dawson (R.), Ross (James), Donald, Thornton, Ross (Peter R). Class II. Taylor, McGibbon (R.); Lyman (A. C.) and McKay, equal; Lynn; Torrance and McCrae, equal; Lawford, MacFarlane; McLaren and McKillop, equal; Powell. Class III. Whiteside, McFayden, Evans, McKeen, Guerin, Shearer, Ritchie (G. W.), Imrie, McIntosh.

DEPARTMENT OF PRACTICAL AND APPLIED SCIENCE.

Engineering.—Senior year. Class I. Dawson (W. B.). Class II. Batcheller, Ross (G.), Hawley. Class III. Frothingham; Page and Wilson, equal.

Middle year. Class I. Chipman. Class II. Thomas, Hethrington. Class III. None.

Junior year. Class I. Sproul. Class II. Pasche, Nelson, Ross (Phil.), Caswell. Class III. Clements.

Mining.—Senior year. Class I. None. Class II. None. Class III. Wilkins.

Mathematics.—Junior year. Class I. Sproul. Class II. Clements, Pasche. Class III. Melson, Ross (Philip), Caswell.

Middle year. Class I. Chipman. Class II. Ried. Class III. Thomas (A. C.).

Mathematical physics.—Middle year. Class I. Chipman. Class II. None. Class III. Thomas (A. C.), Hethrington.

Senior year. Class I. Dawson (W. B.). Class II. Page, Hawley. Class III. Hill, Ross, Batcheller.

Experimental physics.—Middle year. Class I. Chipman, Thomas (A. C.), Hethrington. Class II. Reid. Class III. Rogers (R. B.).

Senior year. Class I. Batcheller, Frontingham, Wilkins;

Page and Wilson, equal; Hawley, Ross (G.), Hill. Class II. None. Class III. Rodger.

Chemistry.—Middle year. Class I. Sproul and Chipman (Middle year), equal. Class II. McNie, Ross (P. D.), Pasche. Class III. Nelson, Howard, Clements, Caswell.

Geology.—Senior year. Class I. Hill, Hawley, Page, Ross, Batcheller. Class II. Frothingham, Wilson, Rodger. Class III. None.

Zoology.—Middle year. Class I. Chipman. Class II. Hethrington, Reid, Thomas. Class III. Rogers (R. B.)

English.—Senior year. Class I. Sproul, Ross (Philip). Class II. McNie, Pasche, Nelson.

French.—Junior year. Class I. Sproul, Pasche. Class II. Ross (Philip) Nelson. Class III. Clements, Howard.

Middle year. Class I. None. Class II. Chipman, Thomas. Class III. None.

Senior year. Class I. Dawson (W. B.) Class II. Frothingham, Hill, Ross; Page and Hawley, equal; Batcheller. Class III. Wilson, Rodger, Wilkins.

German.—Middle year. Class I. None. Class II. Hethrington. Class III. None.

On behalf of the Faculty,

ALEXANDER JOHNSON, LL. D.

GEORGE CORNISH, LL. D.

McGill College, Dec. 29th, 1874.

Industrial Education in the United States.

The United States Department of Agriculture report for 1874, just received, contains a comprehensive and interesting article upon the Progress of Industrial Education in that country. From this we learn that all the land scrip granted by Congress, under the act of July 2, 1862, for the benefit of industrial colleges, has been delivered by the government to the several states, Arkansas and Florida having received theirs a short time ago. Twenty-six states have sold all the land which they received; Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, New York, and Wisconsin have sold only a part; and Nebraska, Nevada and Oregon still retain theirs intact. The number of acres sold by the colleges of the states thus far is 7,868,473, and the number remaining unsold is 1,237,844. No land has been sold recently for less than 90 cents per acre, and sales have been made by Kansas and Minnesota at an average of \$4.33 and \$4.45 per acre, respectively. In one instance New York sold 100,000 acres at \$4 per acre, and 12,000 at \$4.70 per acre. The amount already received by the colleges of the several states from the sales of the congressional land-scrip is \$10,560,264; and the estimated value of the lands remaining unsold, reckoning them at their present market value, is \$4,289,133.

Large additions have been made by many of the colleges to the endowment fund derived from the congressional land grant. Arkansas, Illinois, Indiana, Massachusetts Agricultural College, New Jersey, Ohio and Pennsylvania have more than doubled, and Connecticut and New Hampshire have tripled theirs. Massachusetts Institute of Technology has increased its endowment fourteenfold, having added to it \$9,000,000. New York and Ohio have added to theirs more than half a million dollars each; and Connecticut, Illinois and Pennsylvania nearly the same sum, respectively. All the states, with the exception of a very few, have added something to the congressional land scrip grant. These additions have generally been made in buildings, land and apparatus, yet several of the states have contributed largely in money. In some instances scholarships have been endowed with private donations, covering the tuition of students, and in others paying their entire expenses. In most of the colleges tuition and room rent are free to all. Besides all these donations, large sums have been given annually by many of the states to defray the current expenses of conducting the colleges. The amount which these colleges have received as donations from the states, counties, towns, and individuals is \$7,292,841, not including the appropriations made for current expenses. A large part of this money has been given by individuals. Cornell university has received more than \$1,500,000 from this source. By comparing the value of the property derived from the land-scrip received from the national government with that derived from other sources it will be seen that for every \$100 given to these colleges by the government the people have contributed \$69, or more than

two-thirds as much. The entire property of all the colleges is valued at \$17,535,475.

Colleges have been established in all the states except Louisiana and Nevada. In thirty-five states there are thirty-eight distinct colleges, and if we count two additional for the states of Georgia and Missouri, which have each two colleges in different parts of the state, but connected with one university and under one government, the number will be increased to forty. All the colleges are in operation except in Florida, Indiana, North Carolina and Texas. The number of professors and assistants at present employed in them is 389, and the number of students in attendance is 3,917. In fifteen of the colleges students occupy a portion of the time each day in manual labor on the farm or in the workshop. Attention is given by twenty-one of the colleges to raising thoroughbred stock for the purpose of giving practical instruction to the students in this department of study, and also for aiding farmers in the several states in supplying themselves with the most approved breeds.

The stock is composed of cattle, horses, sheep and swine, and numbers in all 1,618, valued at \$82,146. The farm implements on the same are valued at \$47,047.

—The Intercollegiate contest, to which we referred a few weeks ago, came off in the New-York Academy of Music on the evening of January 7th. One of the aspirants is credited with the following sentence, or with words to a like effect: "He breasted the winds of circumstance, that he might clothe himself in the rags of common-place upon the slopes of mediocrity." It is gratifying, however, to learn that this gentleman failed to win a prize. Occurrences of this character are to be regretted; but they are the inevitable outcome of undisciplined eloquence, and it is to be hoped that a larger measure of care and criticism will be exercised by the several professors of Rhetoric before the time again comes round for the exhibition of academic declamation. The essays were highly commended by the Examining Committee, and it is worthy of notice that both the prizes for Shakespearian subjects were awarded to students of Cornell University. Enthusiasm over the success of the contest found expression in the proposal to hold the next one in connection with the Centennial Exhibition, and, in pursuance of the advice of Dr. Mc Osh, intercollegiate examinations will in all probability be inaugurated in all the principal subjects of a University course.

—At the meeting of the American Philological Association held at Hartford, the President, Prof. Francis A. Marsh put in a vigorous protest against English orthography, and declared strongly in favor of phonetic spelling. He said:—"Count the hours which each man wastes in learning to read at school, the hours that he wastes through life from the hinderance to easy reading, the hours wasted at school in learning to spell, the hours spent through life in keeping up and perfecting this knowledge of spelling, in consulting dictionaries—a work that never ends—the hours that we spend in writing silent letters; and multiply this time by the number of persons who speak English, and we shall have a total of millions of years wasted by each generation. The cost of printing the silent letters of the English language is to be counted by millions of dollars for each generation. Who has not heard the groans of Germans or Frenchmen trying to learn how our words sound, or read the petitions of the Japanese? And yet literary amateurs fall in love with these squintings and lispings. Their favourite old English editions extend the charms of the fair white paper, clear and graceful type, broad margins, and comely, trusty binding to the spelling which is used in them, and these old forms of words leave an aroma like the old leather of the binding, more delightful than wine. They try to defend them by pleading their advantage in the study of etymology. But a changeless orthography destroys the material for etymological study, and written records are valuable to the philologist just in proportion as they are accurate records of speech as spoken from year to year."

SCIENCE.

The Transit of Venus.

THE OBSERVATIONS AT CAIRO.

The special correspondent of the London *Times*, who accom-

panied the expedition to witness the recent transit of Venus at Cairo, writes as follows.

"The sites chosen at Cairo and Thebes were on the east of the Nile and inundated ground, so as to keep the probable mists as much as possible from interfering with the observation of the phenomena at sunrise on the 9th of December. The Mokattam heights had also the advantage of being above the plain, but not far removed from supplies. The mountain, however, had a road only part of the way up it, and the labor of carrying stone piers and huts to the top was considerable. The summit is a magnificent position, without reference to astronomy. To the southwest, on the far side of the Nile, lie the Sakharah Pyramids, then the Geezeh Pyramids, with the great Pyramid and Sphinx—the latter visible to the telescopes only, while immediately beneath the feet, for the cliffs are nearly perpendicular, rises the citadel, with the old walls of Saladin and its modern mosque. To the left of it are the tombs of the Mamelukes, and to the right the mosques and tombs of the Caliphs, behind these the entire city of Cairo, extending up to the banks of the river. For four days previous to the transit morning the weather was bad. On three of them there was a dense mist everywhere, and on the other day a mist was in the plain in which the Mokattam Hills stood like islands. During the night preceding the transit, there were occasional breaks in the clouds, and in the morning it was plain that they were opening, but it was a question if they would do so soon enough to show the sun's disc plainly before Venus had crossed it. Apparently some English visitors thought the chance worth a considerable effort, for among the shadows of the Mokattam Hills might be seen parti s coming up with telescopes and tripod rests. By sunrise were seen the various observers with their telescopes pointed to the eastern horizon, which was covered with banks of cloud.

"A small break in the clouds showed Venus distinctly to most of the observers, though it was a mere glimpse. The strictest orders had been given not to speak for fear of interfering with the counting time of the observers. Another longer break enabled Venus to be brought into the field of all the telescopes and micrometric measures to be commenced. Alternately hid in cloud and visible for a short period Venus continued her course. The sky was now clear all over the west up to the zenith, and it was obvious that it was a race as to whether the clouds or Venus should first be clear of the sun. Happily, after one long, anxious period of obscurity, the sun was seen to be passing into the clear sky, and there was still a distinct, unbroken thread of light between Venus and the sun's limb, and the critical phase of contact was observed. The instant when the black drop assumed the same depth of blackness as the body of the planet had been the phase adopted as most truly showing that the limbs of Venus and the sun coincided. The times regularly recorded when reduced lay within about three seconds of each other. In the largest telescope, the Lee, as might be expected, contact was seen the latest. As none of the observers spoke at the time to each other, and as the times written down by different clocks or chronometers, had to be brought to the same terms for comparison, there could have been no unconscious influence exercised by one observer on another, and the agreements within three seconds of large and small telescopes must be considered good. The general appearance of the phases is reported nearly the same as that of the Greenwich model. The black drop was considered less long and distinct, but the very close resemblance made the observers feel at home with the work, and prevented nervousness. The approximate time of contact was nearly that predicted. To the exact time the observers will not commit themselves till the stars of the same day are worked out, and the clock errors made certain."

Progress in China.—Recent mails from China have brought intelligence of far greater interest and significance than the settlement of the Formosan difficulty. Under the pressure of a political necessity for rapid communication, the Government sanctioned steps being taken for the erection of a telegraphic line between the capital of Tokien and Amoy, on the coast opposite Formosa. And under an equally imperious demand for coal to feed their war steamers and transports, Li-Hung-chang, the Viceroy of Pehihli, has obtained the Imperial sanction to work the coal mines near a place called Rung Ching, in the south-west of that province, with foreign machinery. Already the order has been despatched to England for the purchase of the necessary plant and the engagement of engineers and skilled miners. With a telegraphic line in one province, and coal mines worked by

foreign engineers and machinery in another, it is impossible that railroads should not quickly follow. China will then find herself compelled to move on, and at an accelerated rate, by a law far more irresistible than any force which could be applied from without by foreign Powers. The obstacles hitherto opposed by Feng-Shuy will disappear as suddenly and as completely as they have done now at the word of command, not only as regards telegraphs, railroads and mines, but in every other direction which progress may take. China enters into a new phase from this time, and these two departures from a traditional policy dating backwards a thousand years will form an epoch in the history of the Celestial Empire. Its foreign relations will, of necessity, be modified by increasing demands for European agencies in the interior to work their mechanical appliances, while there will be an increasing disposition on both sides to accept such modifications of the ex-territorial clause in treaties as may remove one of the greatest obstacles to the free access of foreigners to the interior, and a right of residence for industrial and commercial purposes. In this direction diplomacy will find a legitimate field for the exercise of its best powers, and some consolation for the small part it has had to play in these far-reaching measures of the Chinese Government. There is nothing, perhaps, more significant, and at the same time so instructive, as the conclusion to be drawn from the history of these unforeseen advances. Not only diplomacy was powerless to effect either of the objects now attained by the independent action of the Chinese Government for their own ends, but these immediate ends would have had no existence save for the efforts the Chinese have been making these twenty years past to create arsenals and steam fleets for warlike purposes and with hostile rather than peaceable intentions towards foreigners. The results so long desired in the interests of foreigners are due least to the means taken by the Chinese to place themselves in a position to resist all attempts on the part of the Treaty Powers to secure them.—*Pall Mall Gazette.*

Engineering two thousand years ago.—Perhaps some of the most remarkable remains of ancient engineering are those which were discovered by excavations made some ten or twelve years since, a short distance from Rome, and near the ruins of the ancient city of Alatri. This city was surrounded by massive walls, and located on a mountain or elevated point, and ill-provided with water. About 150 years before Christ, as we learn from a Roman inscription, an immense aqueduct was built to bring water from a neighbouring mountain better supplied with that element. We are furthermore told that this aqueduct was 340 feet high, supported upon arches and provided with strong pipes. The topography of the country, moreover, assures us that the water supply could not have been conducted into the city, even over such high supports, except by pipes—an inverted syphon—the lowest point of which must have been some 340 feet below the point of delivery, or under a pressure of at least ten atmospheres. The excavations already alluded to show that the aqueduct must have been of large size, as the piers of the arches are not less than five feet nine inches in breadth, while the total length of the syphon must have been between four and five miles. The question naturally arises—How, and of what material, was this syphon built? As iron pipes of large dimensions, if of any dimensions at all, were not known at the era, we can look only to masonry or woodwork for the material of such construction. Possibly a clue has been found to the mode of their construction by a subsequent discovery, near the same locality, of a field, supposed to have been the site of an ancient parade ground near this once walled city of Alatri. A complete system of underground drainage has been revealed at a depth of about 7 feet below the surface of the field, effected by a well constructed system of pipes made of fire-clay, each about 18 inches in diameter. It is possible that such a pipe, of larger dimensions, and strengthened on its exterior by a strong and massive bulwark of masonry, may have been the means of conveying the water into the city. But however that end might have been attained, the work was certainly a most wonderful feat of engineering, considering the condition of the mechanic arts of that early day. The excavations and discoveries thus brought to light, and so fully confirming the truth of the ancient inscription, were conducted by order of the present Pope, and under the immediate supervision of the well-known Italian scientist, Father Secchi.

To obtain light without the use of matches.—To obtain light instantly without the use of matches and without the danger

of setting things on fire, take an oblong phial of the whitest and clearest glass; put into it a piece of phosphorus about the size of a pea, upon which pour some olive oil, heated to the boiling point, filling the phial about one-third full, and then cork the phial tightly. To use it, remove the cork and allow the air to enter the phial, and then recork it. The whole empty space in the bottle will then become luminous, and the light obtained will be equal to that of a lamp. As soon as the light grows weak its power can be increased by opening the phial and allowing a fresh supply of air to enter. In winter it is sometimes necessary to heat the phial between the hands to increase the fluidity of the oil. Thus prepared, the phial may be used for six months. This contrivance is now used by the watchmen of Paris in all magazines where explosive or inflammable materials are stored.

MISCELLANY.

Sleep and no sleep.—It is a religious duty to sleep, and to sleep enough; and he who does not, may be sure that he is breaking the Sixth Commandment, which requireth all lawful endeavors to preserve our own life, as well as the lives of others.

There is scarcely a better health meter for men who think much than this. Hard mental work is beginning to kill when it interferes with sleep, and he who plies his brain with ever so much energy eight or ten hours a day, prays and plays five or six, and sleeps seven or eight, will never die of over-work. But he must make a business of it. Brain-work, food, exercise in the open air, culture of the soul, social relaxation and sleep,—these are the constituents of good living, and they will be attended by health, wealth, usefulness and happiness. If anything else is wanting, it will be added thereunto.

The old theory was that sleep is induced by the pressure of blood on the brain. Because the stupor of apoplexy follows congestion of the brain, it was held that sleep was somewhat like an incipient disease; a very stupid theory, for sleep, so far from being like disease, is "the sweet restorer" of the waste that brainwork makes. Congestion is imminent when the brain is pressed hard with blood, and it is doing more than its duty. But when the brain has been laid bare by removing a portion of a skull of a living animal, it is obvious to the eye that as sleep comes, the brain occupies less space than before, and as the animal awakes, the brain expands and fills the cavity again. Sometimes, on rising suddenly in bed from a sound sleep, one is dizzy or lightheaded, and that is because the blood has not had time to regain its normal circulation in the upper story. And it is not well to spring up quickly on waking; take things moderately then, as at all times. Thus we see the necessity of sleep, that the waste of the whole nervous system, occasioned by the wear and tear of mental and physical labor through the day, may be repaired. You cannot make machinery of the hardest steel and of the most polished surface that will not wear out or break down. And all the machinery on earth combined would not show workmanship so delicate, and finished, and fitted for such exquisite service as the body and the mind of a man.

It has been publicly stated that ten bank presidents in this city were killed by the commercial crash of 1857. Not one of them would have died of that disaster had he given ten hours a day to business and eight to sleep. I do not know what Shakespeare meant when he wrote that "sleep knits up the ravell'd sleeve of care;" but I well know, by long experiment, that when care has wasted and unravelled the web of life, so that the man is falling into sixes and sevens, like an old stocking or knitted sleeve, then kind sleep comes to his aid, knits it all up again, and makes him as good as new. The victims of no sleep from our banks and stores, go wandering over Europe like the spirits in the gospels, seeking rest and finding none, because they hastened to be rich, and would not, and then could not, sleep.

Prince Albert, that model prince consort, worth any dozen kings of the common herd, gave a written certificate to the value of a recipe for going to sleep, of which a man claimed to be the discoverer. But it was in use long before His Royal Highness was dreamed of, and is of no great value. The only directions worth repeating are to "stop thinking," and in order to do that most difficult of all things for a thinking man

to do, headwork and handwork must be suspended at an early hour, the mind relieved by such light employments as will divert thought from the serious business of the day, and the nervous system will thus be calmed and soothed, so as to induce that peace which foretells sleep. The devices are many and curious to win this boon. But they all amount to the same thing,—the diversion of thought from any subject that excites mental effort. Hunger and cold are unfavorable to sleep. It is not so unwhole some as many suppose, to go to bed after a good supper. The sleep of infancy always follows it. All dumb animals eat and then sleep. Reason forbids gluttony, and reason also forbids going to bed with a stomach craving food. Keep the body warm and the head uncovered, so that the blood may be tempted away from the brain, and not into it.—*Irenæus, in N. Y. Observer.*

A literary curiosity.—The following lines it will be seen have been written by different persons, but so carefully are they arranged that one would be apt to suppose that they were the productions of one author.

L I F E .

- Why all this toil for triumphs of an hour?
—Young.
- Life's a short summer—man is but a flower;
—Dr. Johnson.
- By turns we catch this fatal breath and die.
—Pope.
- The cradle and the tomb, alas! so nigh.
—Prior.
- To be better far than not to be,
—Sewell.
- Through all man's life may seem a tragedy;
—Spencer.
- But light cares speak when mighty griefs are dumb
—Daniel.
- The bottom is but shallow whence they come.
—Sir Walter Raleigh.
- Your fate is but the common fate of all;
—Longfellow.
- Unmingled joys here no man b fall;
—Southwell.
- Nature to each allots his proper sphere,
—Congreve.
- Fortune makes folly her peculiar care:
—Churchill.
- Custom does not often reason overrule,
—Rochester.
- And throw a cruel sunshine on a fool.
—Armstrong.
- Live well—how long or short permit to heaven
—Milton.
- They who forgive most shall be most forgiven.
—Bailey.
- Sin may be clasped so close we cannot see its face
—French.
- Vile intercourse where virtue has not place,
—Sommerville.
- Then keep each passion down however dear.
—Thomson.
- Thou pendulum betwixt a smile and tear;
—Byron.
- Her sensual snares let faithless pleasures lay,
—Smollet.
- With craft and skill to ruin and betray,
—Crabbe.
- Soar not too high to fall, but stoop to rise,
—Massinger.
- We masters grow of all that we despise.
—Crowley.
- Oh, then, renounce that impious self esteem,
—Beattie.
- Riches have wings; and grandeur is a dream.
—Cowper.
- Think not ambition wise because 'tis brave,
—Sir Walter Davenant.
- The paths of glory lead but to the grave.
—Gray.
- What is ambition? 'Tis a glorious cheat,
—Willis.
- Only a destructive to the brave and great.
—Addison.

What's all the gaudy glitter of a crown ?
 —Dryden.
 The way to bliss lies not on beds of down.
 —Francis Quarles.
 How long we livr, not yeers but actions tell,
 —Watkins.
 That man lives twice who lives the first life well.
 —Herrick.
 Make, then, while yet ye may, your God your friend,
 —William Masson.
 Whom Christians worship, yet not comprehend.
 —Hill.
 The trust that's given guard, and to yourself be just,
 —Dana.
 For live we how we may, yet die we must.
 —Shakespeare.

—The teacher who thinks it is enough to know the lesson of the day and talk about it to his class loses sight of the chief work devolving on him as a teacher—the work of keeping his scholars at work. Dr. Vincent says: "A teacher gets work out of his scholars, gets questions, gets answers, gets hints, gets a good chance to keep his own mouth shut a good part of the time, and the mouths of his scholars open and their brains busy and their hearts excited."

—President Eliot, of Harvard, speaking of the system of local examinations for women that has lately been inaugurated under the direction of that institution, says: "If it be asked what good can examinations by the University do when the University does not teach girls, the answer is that they can do precisely the same service for girls' schools which college admission examinations have done for preparatory schools for boys—they can set a standard and prescribe a judicious programme of study for several years of life between twelve and eighteen. There is now no standard for girls' schools; no means of publicly comparing one school with another; no visible goal for pupils or teachers. These deficiencies the proposed examination may in part supply."

Industrial Exhibitions.—A suggestion has been made to the Commissioners of Education in the United States to encourage "Industrial Exhibitions" in connection with the public schools of that country. It is proposed that the pupils should be induced to bring to the school once a week, or one a fortnight some article of use made by themselves, to be exhibited and explained under the supervision of the teacher, in the presence of the parents and friends. The Commissioner, it is stated, entirely approves of this plan, which he considers to be a practical development and application of the Kindergarten system, and is of opinion that the youngest children, by a wise direction of instinct to make something themselves, may be taught several useful lessons. He also commands the plan as a means of increasing the interest of parents and friends in the schools, and of receiving their visits at the stated intervals, while it would furthermore arouse in the children such an interest in the daily work of the household, the shop, and the farm, as will teach them the value and dignity of labor, and fit them for usefulness.

Watch The Books.—How large a proportion of mothers and guardians exercise anything which can be called watchful care as to what books and papers the children shall read? And yet the booksellers' shelves groan under the weight of the most dissipating, weakening, and insidious books that can possibly be imagined; and newspapers which ought never to enter any decent house lie on the table of many a family sitting-room. Any one who will take the trouble to examine the records of any large circulating library will be astonished at the immense demand which there is for these average novels. And, in our parlors and chambers to-day, myriads of little girls are curled up in corners, poring over such reading—stories of complicated modern society, the very worst kind of reading for a child; stories "whose exciting pages delight in painting the love of the sexes for each other, and its sensual phases." And the mothers do not know what they are reading; and the children answer, when asked what they read: "Oh anything that comes along!"—*Anna C. Brackett.*

Why the boys leave the farm.—A contributor to the *Country Gentleman* supplies the following sound reasons for boys not having sufficient attraction to become naturalized farmer:—
 One is because their tastes and opinions are not consulted

enough. Another is that from the time they are large enough to do a few chores till they are twenty one, it is apt to be work, work, from morning till night, the year round, without hope of other reward than their board and clothes. The father seldom consults his son in regard to his plans about the farm, and as the boy grows older, he cares very little about them. After the work for the day is done, the boys come in and want something to do; they have been at work all day and their muscles are tired, but their brains have been resting all day and are pining for exercise. They look around, and perchance see a paper full of politics, or a paper whose columns are filled with local news of trivial importance, which they have read over and over, but see no books which tend to enlighten the mind and elevate the soul. Having nothing else to do, they go down to the village, and there they soon learn to smoke, chew and swear with dissolute companions. After a time they come into contact with one of those fellows who has been off to "seek his fortune" and come home "dead broke" to live on his friends. They listen to his stories of adventures by land and sea, and, since they have seen little of the world outside of their native town, believe all he says; and as they have seen none of the advantages of a farmer's life, but all its disadvantages, they are disgusted with it, and resolve to get away from home and try their fortune in other parts. Here they make a great mistake, for they have no education, no trade, no money, and are perfectly friendless in the great world; and the vices of their boyhood still cling to them, dragging them down. And after being knocked about from place to place, until hard work and debauchery have broken their constitutions, they return to their native town, homeless, penniless, friendless, to drag through a few more years and then sink into the grave, with few to mourn their loss or take warning by their example.

In order to make them stay on the farm, you should get them interested in farm work, tell them your plans, ask their opinion, and when they have given it, ask them why they think so and so, and what has led them to such a conclusion. Draw out their thoughts, procure good agricultural and literary papers and books. Perhaps you will say that you have not the money to spend for these things; but stop a moment and consider how much it has cost you for tobacco for the past year, and then resolve that you will never touch another particle of the weed, which has been the means of clouding your brain and darkening your intellect for many years; take the money which you will thus save in this, and purchase some books, not those trashy, yellow-covered things, but books written by our authors, no matter what they treat on, whether it be farming or astronomy; get something that will interest your sons. Once get them to reading, and they will take to good literature like ducks to the water, and instead of spending their hours at the village tavern they will be storing their minds with useful knowledge, that will be of infinite value to them as they grow up.

As soon as they begin to read they will want to try experiments for themselves. Let them have a good piece of ground, help them to plough and get it ready, and then tell them to go ahead. If they come to you for advice, give it; but do not tell them they must do this, and they must not do that, for they have quick perceptions, and if your advice is good they will soon find it out and follow it. Soon they will begin to talk about fixing up the house a little, and setting out some fruit and shade trees. A coat of paint, a few new blinds, and numerous other little attractions, render your house hardly recognizable to one who saw it a year ago, although your purse has not been made much lighter by the outlay. Then go the woods and get some trees, and plant them around the house, and in a few years they will make a delightful shade, which you can enjoy on a hot midsummer's day. Next help the girls to prepare some flower beds, which will add wonderfully to the beauty of your grounds. Next plant a hedge in place of the old, broken-down fence in front of the house, and other improvements of like trifling cost will follow in due time, the carrying out of which will render your home a lovely spot, which your children would never for a moment think of exchanging for a city home, and where you can live out the remainder of your days in peace, and go down to the grave having bid farewell to your children joined in love and harmony around your couch.

Nature's School.—By B. G. Northrop—The best sort of kindergarten is the open fields and varied objects of the country, if only the eye be trained to habits of careful observa-

tion. Nature is then the best teacher of the juvenile mind. Things are studied more than mere words; or, rather, the perception of objects and their characteristics gives precision to thought and language. To give one of many illustrations, how different would have been the history of the great naturalist of our day had he spent his childhood in a large city. How fortunate for Agassiz and for the world that his native home was the humble parsonage of a plain but intellectual clergyman in the little village of Mottier, in Switzerland. Though early instructed by his intelligent parents, he did not attend school till he was eleven years of age. The woody hills, the gardens and vineyards, the brooks, cascades, and lakes, the Jura and more distant Alps, with magnificent glaciers, glistening fields of snow and ice—these were his real teachers. This plain, rustic Mottier, lying midway between the lakes of Neuchatel and Morat, its old stone houses, with projecting roofs of red tiles and the stairs on the *outside* reaching to the balconies that surround the second story, these balconies often serving as storeroom and filled with onions, squashes, and various other vegetables, and sometimes beautiful and fragrant with potted flowers; the streets narrow, winding, and irregular; the houses facing in all directions, like so many dice—such were the surroundings of his boyhood.

A boy's play may become a useful drill. Agassiz's sports were admirably fitted to convert the observing boy into the future naturalist. They were boating, fishing, hunting; studying birds and turtles; gathering bugs, butterflies, and other insects; roaming in the woods; taking long excursions on Lake Neuchatel, whose waters are so clear that the bottom is plainly seen at an unusual depth, enabling him to find the haunts and study the habits of the fish; traversing the valley of the Orbe, after his father moved to that place, on the other end of Lake Neuchatel; climbing steep hills and rocky cliffs, and even ascending the magnificent precipices of the Jura. Living much in the open air, he observed the birds, so as to distinguish them by their beak, claws, size, form, plumage, might, or song. If in early life he knew less of books, he had studied Nature more. The habits of observation thus formed and the love of knowledge thus awakened admirably prepared him for the school books, which he afterward perused with enthusiasm.

I have often advised the sons of wealth in our cities to spend at least one year in the country, with its freer sports and wider range of rambles; or, better still, for both physical and mental training, to give one season to hard work on the farm or in the shop. The practical skill thus gained in contriving and adapting means to ends, in observing men and things, and studying Nature and domestic animals, may fully compensate for some loss of book learning, or lead one, like Agassiz, to pursue text books with still greater zest—*N. Y. Independent.*

—The following is a copy of the brief but comprehensive law "relative to the attendance of children at school" which was enacted by the Legislature of New Jersey at its last session and is now in force in that State. "Every parent, guardian, or other person, having control and charge of any child between the ages of eight and thirteen years, shall cause such child to attend some public or private school at least twelve weeks in each year, six weeks at least of which attendance shall be consecutive; or to be instructed at home at least twelve weeks in each year in the branches of education commonly taught in the public schools, unless the physical or mental condition of the child is such as to render such attendance inexpedient or impracticable. And for every neglect of such duty the party so offending shall forfeit to the use of the city, town, borough, or school district in which such child resides a sum not exceeding twenty dollars, to be recovered in any court of competent jurisdiction in the county in which such city, town, borough, or school district may be situated; provided, however, that the aforesaid penalty shall not be imposed if it shall be satisfactorily proven upon the trial of the case that the parent, guardian, or other person so neglecting was unable by reason of extreme poverty to comply with the requirements of this act.—*N. Y. Independent.*

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Meteorology.

Observations taken at Halifax, Nova Scotia, during the month of December, 1874; Lat: 44° 39' North; Long. 63° 36' West; height above the Sea, 125 feet, by 2nd Corporal J. T. Thompson, A. H. Corps.

Barometer, Highest reading, on the 1st.....	30.534 inches.
" Lowest " " 18th.....	29.106
" Range of pressure.....	1.428
" Mean for month (reduced to 30 F).....	29.867
Thermometer, Highest reading on the 7th.....	52.7 degrees.
" Lowest " " 23rd.....	-6.4
" Range in month.....	59.1
" Mean of all highest.....	36.0
" " " lowest.....	16.5
" " " daily range.....	19.5
" " " for month.....	26.2
" Highest reading in sun's rays.....	89.0
" Lowest reading on the grass.....	-6.5
Hygrometer, Mean of dry bulb.....	27.9
" " " wet " 	27.0
" " " dew point.....	23.3
" Elastic force of vapour.....	.134 grains.
" Vapour in a cubic foot of air.....	1.45
" " required to saturate air.....	.35
" The figure of humidity (Sat. 100).....	.81
" Average weight of a cubic foot of air.....	568.6
Wind, Mean direction of North.....	5.50 days.
" " " North East.....	2.50
" " " East.....	0.00
" " " South East.....	1.00
" " " South.....	1.00
" " " South West.....	5.50
" " " West.....	4.00
" " " North West.....	9.00
" " " Calm.....	2.50
" Daily force.....	2.95
" " horizontal movement.....	258.9 miles.
Cloud, Mean amount of (9 to 10).....	7.0
Ozone, " " (0 to 10).....	1.8
Rain, Number of days it fell.....	8
Snow, " " " 	10
" Amount collected on ground.....	6.23 inches.
Fog, Number of days.....	1