

grand principles of strategy persist, and so do the laws governing the command of men. Yet the *conditions* of warfare are changing. Simplicity is giving place to complexity. Woe to that nation which fails to note the signs of the times. War is a serious thing, but it is more serious to the vanquished than to the victor. It behooves every nation to see that by no chance shall it be vanquished. No means of offense or defense must be neglected, because it seems too delicate or too expensive, provided only that it can be made to be efficient. Science is daily coming more into our lives, as the number of those who study her increases; but in no department of life is she making more progress than in warfare; and in warfare no branch of science is making more progress than electricity.

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ON SCHOOLS: WITH PARTICULAR REFERENCE TO  
TRADES SCHOOLS.

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[Continued from vol. cxxx, p. 144.]

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Herr Kjennerud, after completing his description of the method of instruction adopted at Fredrickshald, goes on to say, that "it has been maintained with great force and with much justice that hand-work does not have its full rights unless it is regularly incorporated in the school course, and receives such treatment that it may exert an educating influence on the child, inasmuch as, like modelling and drawing, it aims to develop the pupil's eye, and his sense of form and of beauty." "Therefore it should have an acknowledged place, in the higher as in the lower schools." Hand-work "may certainly very easily be somewhat overrated as positively refining, and some may in a great measure, fail to look at its practical side." Hand-work, however, "can scarcely be ranked too high as a link in the true education." It is not necessary here "to consider its significance as to moral training, but if we start with the

idea, which has already been acknowledged, that schools should impart such skill to female children as every child should possess, so ought the public school to give instruction to boys in the use of the hands, so that every man, to whatever station he belongs, shall have acquired such power that he may not stand helpless in any occasion of life, in consequence of a one-sided education; then a path will have been broken by which to arrive at a method in which the school must work."

Herr Kjennerud further says that "the exercises should begin with the handling of the tools most often used in daily life, as for example the knife, axe, hammer, plane, saw, file and possibly the paint brush." "The chief importance must be attached to joiners' work for the reason that he who understands how to handle joiners' tools will have little difficulty with other simple work." "Although turning will train the eye and the sense of form and symmetry, it must still take a subordinate place, particularly where there are not the means to procure the necessary tools." "A little wood-carving can be practised, not only because it serves in a high degree to cultivate and refine the taste, but a little experience will enable one to produce tasteful pieces of work for his own recreation."

"Whittling should not be neglected, as the knife is a tool for the use of which many opportunities will be found at home."

"Whether basket-making should have a place in school is exceedingly doubtful." The material is one that will easily take any required form, the work can be made instructive, and articles for both use and ornament can be manufactured; but much practice and strong hands are needed; the work is of inferior strength and durability; the material cannot be procured in many places, and "it cannot be maintained that exercises in basket-making have a general value."

"Painting, particularly of manufactured articles of wood, appears quite suitable for work-schools." A short course in smith's work and practise in the use of the file, would be advisable, and in many cases a forge is not necessary. Tin-

plate work is less necessary, although a knowledge of soldering often comes into use and is quickly learned.

"It can hardly be allowed that shoemaking is of great importance as a means of cultivation. The position required during work is by no means the most suitable for bodily development. It is stated that the medical council of Dresden, Germany, for this reason expressed themselves against its introduction as a school branch." "Still, skill in mending shoes is so important for people of the working classes, both economically and on sanitary grounds, that its place in school may be said to be justified on this account, which cannot be said of tailoring, for which the boys have shown no liking."

"Bookbinding is hardly of practical importance, except for those schools in which there are children in whose homes there are books to bind."

"The work to be carried out should be particularly limited to actually useful objects, and such as do not lie above the pupil's power to make with little assistance. It should be customary for the pupil, as far as possible, to be self-helping, and he should not be deprived of the satisfaction and encouragement to diligence and perseverance, which are always sure to follow when one has accomplished a piece of work with only his own help." "And that there may be opportunity for the development of taste and a sense of beauty in work, when procuring models, the coarseness and ugliness which often characterizes the work of schools should be avoided."

One further extract from Herr Kjennerud's remarks will be sufficient for our present purpose. He states that "a plan derived from any other fundamental principle than that the school is for life in general, will very certainly lead astray, as has happened," in his opinion, "in some places in Sweden, where a disproportionate number of hours has been assigned to hand-work, even as many as half the whole time of instruction." "With three to six hours a week obligatory hand-work, running through two or three years, any reasonable demand would appear to be satisfied."

THE DEPARTMENT OF SCIENCE AND ART OF THE COMMITTEE  
OF COUNCIL ON EDUCATION, LONDON.

The Department of Science and Art was established in connection with the Board of Trade in March, 1853, as a development of the Department of Practical Art, which in 1852 had been created for the reorganization of schools of design, and it was placed under the direction of the Committee of Council on Education in 1856.

The head of the Department is the Lord President of the Council, and he is assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, who acts under the direction of the Lord President, and for him in his absence.

A sum of money is appropriated annually by Parliament for the promotion of instruction in science and art in the United Kingdom, especially among the working classes, and it is administered by this Department. It is applied to the maintenance of the science and art museums at South Kensington, in Dublin, and in Edinburgh; of the Normal School of Science and Royal School of Mines and the National Art Training-School at South Kensington; of the Royal College of Science and the Metropolitan School of Art in Dublin, and to aid in the establishment and maintenance of local schools and classes for instruction in science and art and of local museums of science and art.

The aid is granted in the form of—

(1) Payments to the committees of schools and classes, on the results of instruction, and certificates, prizes, medals, free studentships, scholarships and exhibitions to the students.

(2) Building grants, and grants for the purchase of apparatus, examples, fittings, etc.

(3) Aid to teachers and students in attending the Normal School of Science and the National Art Training-School, South Kensington; the Royal College of Science, Dublin, and other approved centres.

(4) Loans and grants to local museums and to science and art schools.

(5) Aid to training-colleges for instruction in science and art, and to elementary schools for instruction in drawing.

The schools and classes must be those approved by the Department and they must be open at all times to the visits and inspections of its officers.

The Department is the sole judge as to grants and awards, and they may be withheld wholly or in part for any breach of the rules.

The appropriation funds depend upon the action of Parliament, and are liable to be decreased and eventually discontinued. There is, therefore, no guarantee that they will be perpetual, and it is particularly impressed upon those who benefit by them that they must not be considered as in any way establishing a claim to any payments beyond those offered from time to time. The payment of fees by students must be looked upon as essential to the maintenance of a proper system of instruction, and though at present this is not made an absolute condition of the grants, yet gratuitous instruction is only permitted exceptionally and in those places where schools or classes have but recently been established, or it can be shown to the satisfaction of the Department that the circumstances of the locality justify this relaxation of the rule.

The standard of fees must necessarily vary in different localities according to the rate of wages and other circumstances, but committees of schools should fix as high a rate as they consider can fairly be imposed and they must certify annually to the fees received. No school or class is permitted to charge abnormally low fees in order to compete with the others in the same locality. The committees of the various schools and classes are expected to fix together some minimum fee for the district.

Students of a training-college, pupils of an elementary school who pay the regular fees of that school, pupil-teachers in elementary schools, art pupil-teachers and holders of free studentships may be exempted from fees.

Every science or art school or class must be under the superintendence and management of a local committee, who engage the teachers, are generally responsible for it, and

conduct, or assist in conducting, the examinations. The committee are also responsible for all apparatus, fittings, etc., towards the purchase of which the Department has granted aid.

There are a number of rules governing the formation of a committee. It must be composed of a chairman, secretary, and at least three other members, as many persons as possible in recognized positions of public responsibility in the district being placed on the committee.

A regular series of forms and instructions are provided for guidance in establishing and maintaining schools and classes. Each school or class, as formed, is assigned a distinguishing "school number," and every year a new application form must be returned to the Department on or before October 31st, a deduction of half a crown per day being made from the next payment to the school for each day's delay in sending the return beyond that date. Annual reports must be sent in from each school or class. In certain cases the Department will permit the organization of a committee for the purpose of conducting examinations of a school or class which receives no grants.

It will be noticed that the aid granted by the Department is intended only to supplement, not supersede, local effort. The local committee is obliged to provide and maintain suitable rooms for the classes, etc., and if at any time these appear unsatisfactory or insufficient, or if there is reason to believe that the instruction or supervision is inefficient, the assistance of the Department may be reduced or withdrawn.

A grant may be made, under certain specified regulations, in aid of a new building, or for the adaptation of an existing building, for a science or art school, at a rate not exceeding 2s. 6d. per square foot of internal area, up to a maximum of £500 for any one such school.

Grants are also made for fittings, apparatus and examples, under certain regulations, to an amount not exceeding fifty percent. of their cost, and there are special rules for endowed schools. The Department has a lien on all objects purchased with its aid, one-fifth of which determines with each

year of actual use, and after five years the objects become the property of the committee.

Teachers are required to be qualified in accordance with certain examination rules, and the class in each subject of science, or group of subjects of art, must meet under the instruction of a qualified teacher, on at least twenty-eight days during the session, each meeting being of at least an hour's duration.

Every school or class is obliged to make an annual return before October 1st of its teaching staff and time-table of instruction for the current session, and in case of an old school or class, the statistics for the past session.

The examinations are of two kinds, personal and examinations of works. The personal examination of students in science and art are held annually about May, and of training-colleges about October and December. The May examinations are open to external candidates. The examination of works commences in April, the works being sent to the Department for that purpose.

There are certain rules and regulations, which need not be detailed here, for the conduct of examinations, for arrangements for local examinations, for applications for examination papers, for the custody of such papers, to prevent the possibility of any tampering with them, and for re-examinations.

Payments are made to local committees on the results of instruction as tested by the examination of students, on condition:

(I) That the teacher is qualified under the regulations.

(II) That the teacher has given at least twenty-eight lessons during the session on the subject of science, or group of subject of arts, on which payment is claimed.

(III) That each student, on account of whom a claim is made, belongs to one or other of the following categories:

(a) Persons in the receipt of weekly wages, and their children if not gaining their own livelihood.

(b) Teachers and pupil-teachers of elementary schools in connection with the English or Scotch Education Departments, or the National Board of Education in Ireland, and their children if not gaining their own livelihood.

(c) Persons in the receipt of not more than £200 per annum from all sources, and their children if not gaining their own livelihood.

(d) Scholars in Public Elementary Schools within the meaning of the Elementary Education Acts.

(e) A member of a *bona fide* night class for industrial students, which meets after 6 P.M., or on Saturdays, after 2 P.M.

(IV) That each student on account of whom payment is claimed in any subject, has received twenty lessons, at least, in that subject of science—or in art in the requisite group of subjects—and that the attendances have been duly registered.

(V) That all such attendances have been made within the two years immediately preceding the examination on account of which the claim is made, and under the supervision of the same committee.

It is not deemed necessary to give here the details or amounts of the payments that are made. Medals, prizes, certificates, scholarships, etc., are awarded to students on results of examinations. There is quite a large list of these awards, which are often of very considerable value, and naturally act very effectively as incentives to study and improvement.

Grants are made to aid local efforts in founding scholarships and exhibitions, these grants, however, being only made on the condition that the scholarship or exhibition is awarded on the results of a competition, and that a sufficient sum is provided for the special purpose of the scholarship or exhibition, by the voluntary contributions of living persons.

In reference to the science and art scholarships, these must be awarded in competition among the pupils of any elementary school or schools not conducted for private profit. The object of the scholarship is to enable the committee of the local fund to maintain the successful competitor, while pursuing his studies, for one, two or three years, at a day-school approved by the Department.

The managers of the local fund must contribute £5 each year to the Department before April 5th, and this



local contribution will be supplemented by the Department with a grant of £4 for the first year; £7 for the second; and £10 for the third year. It will rest with the locality, however, to decide whether the scholarship shall be tenable for one, two, or three years. There are certain conditions governing these scholarships.

In reference to local exhibitions, the Department makes a grant of £25 per annum to the managers of the local fund, who raise by voluntary subscription, and furnish before the fifth of April the like sum for the maintenance of a student at some college or school where a thorough course of instruction in science or art of an advanced character may be obtained. His whole time must be devoted to instruction, and there are certain conditions to be observed in making the award.

Great liberality is shown in granting free admissions to museums and libraries to students, teachers and other persons of certain classes and conditions.

Grants are allowed in aid of the purchase of objects for museums in connection with schools of science and art, or established under the Public Libraries Acts, or otherwise under a municipal governing body. These grants are primarily intended to assist local museums in obtaining reproductions in plaster, or by the electrotype process, or by photography; but they are not absolutely limited to reproductions. They may be made for the purchase of original objects of art or science, but in considering applications preference is always given to those for reproductions. The objects must be approved by the Department of Science and Art; no grant will be made toward the carriage of the objects, and no object on which aid has been granted can be sold or exchanged without the permission of the Lords of the Committee of Council on Education.

Collections of objects of science and art are loaned for a short period of exhibition to schools and for an extended period to permanent museums, either at schools or established under the Public Libraries Acts or under municipal authority. Exceptional loans are also made where no schools or museums exist, provided always that the proceeds

of the exhibition are used to further or establish a school of science or art or a municipal museum.

The museums and libraries at South Kensington contain objects, books, drawings, etc., illustrative of, and apparatus for, teaching the following subjects :

Machine construction,	Chemistry,
Building construction,	Animal physiology,
Naval architecture,	Botany,
Theoretical mechanics,	Navigation,
Sound, light and heat,	Steam,
Magnetism and electricity,	Physiography,
Principles of agriculture,	

and the following branches of art :

Sculpture in marble, stone, etc.	Enamels on metals,
Mosaics,	Pottery and porcelain,
Carvings in ivory, bone, etc.,	Glass vessels,
Woodwork,	Stained glass,
Metal work,	Leatherwork, including book-binding,
Coins and medals,	Textile fabrics,
Arms and armor,	Lace,
Silversmith's work,	Musical instruments,
Jewelry,	
Decorative paintings.	

Apparatus, paintings, drawings, etc., are lent to schools of science and art, for purposes of study under certain conditions, these loans being of two kinds—the deposit loan, the objects being left for considerable periods; and the temporary loan, usually made for a time of twelve weeks, which under certain circumstances, may be extended.

#### REGULATIONS SPECIAL TO SCIENCE.

Aid is given towards instruction in the following subjects of science :

- (1) Practical, plane and solid geometry.
- (2) Machine construction and drawing.
- (3) Building construction.
- (4) Naval architecture.
- (5) Mathematics.

- (6) Theoretical mechanics.
- (7) Applied mechanics.
- (8) Sound, light and heat.\*
- (9) Magnetism and Electricity.\*
- (10) Inorganic chemistry (theoretical).
- (10p.) Inorganic chemistry (practical).
- (11) Organic chemistry (theoretical).
- (11p.) Organic chemistry (practical).
- (12) Geology.\*
- (13) Mineralogy.
- (14) Animal physiology.\*
- (15) Botany.\*
- (16), (17) Biology including animal and vegetable morphology and physiology.\*
- (18) Principles of mining.
- (19) Metallurgy (theoretical).
- (19p.) Metallurgy (practical).
- (20) Navigation.
- (21) Nautical astronomy.\*
- (22) Steam.
- (23) Physiography.
- (24) Principles of agriculture.
- (25) Hygiene.

Each subject is subdivided into three stages of courses—the elementary, the advanced and honors—except mathematics, which is subdivided into seven stages, with honors in three groups of stages.

In the subjects marked with an asterisk there may be a practical as well as a written examination in honors.

The laboratory of a science school must be devoted wholly to practical work in experimental science, and if chemistry or metallurgy be taught, must be supplied with apparatus and reagents in accordance with certain regulations which need not be detailed here. The main height of the laboratory must be at least fifteen feet. If this condition is not observed, no grant towards the laboratory fittings or apparatus will be made. Apparatus grants are confined to articles of a non-destructible nature, only to those of a

permanent illustrative character, which are required by the teacher.

Instruction in experimental science must not be given without sufficient apparatus to illustrate the teaching, and lists are furnished by the Department showing the minimum amount of apparatus with which it is considered necessary that a class should be provided for teaching subjects Nos. 1, 2, 6, 7, 8, 9, 10, 10p., 11p., 12, 14, 15, 19p., 22, 23, 24. No payments will be made, on examinations held in the elementary stage, in schools which are not furnished with the required amount of apparatus, or where advanced instruction is given, without sufficient apparatus to make the experiments referred to in the syllabus of each subject. The teacher is liable to be called upon by the inspector to show his ability to use this apparatus.

Students cannot be registered for lessons in more than two subjects on any one day, or more than one lesson in any one subject—except on a Saturday, when lessons in three subjects may be registered. The lessons in practical inorganic chemistry, practical organic chemistry, and practical metallurgy, must be each of at least one hour and a half's duration.

The examinations in the three stages of a subject—or in mathematics, in a group of stages—are held at the same time, a separate series of questions being given in each stage. The elementary and advanced stages are for the general students in science classes. The honors examination is of a more advanced character. In each stage there are two grades of success—first and second class. In the second or lower class of the elementary stage, the standard of attainment required is such as will justify the examiner in reporting that the instruction has been sound, and that the students have benefited by it; but the standard may be raised from year to year.

In addition to the ordinary science examinations, examinations may be made in mathematics, navigation, nautical astronomy and steam, for the benefit of seafaring men—and for them only—three times a year in all seaport towns where local committees are formed and are willing to undertake

them. These examinations are only allowed when there are at least forty candidates, and in those subjects and stages only in which there are forty candidates in the United Kingdom.

In order that the instruction of students in science may proceed methodically, a course of instruction has been prepared for both day-schools and night classes. The number of subjects which a student can take up in one year will depend upon circumstances, especially if he only attends night classes, but it is not necessary that he should take in any one year all the subjects mentioned in that year. If special grants (as provided) are claimed, however, his studies must comprise the subjects given in the course, and in the order there stated. The student is supposed to be already familiar with the elements of arithmetic and the primary conceptions of physical science, through his studies in the elementary school.

The course of instruction is as follows :

*First Year.*

Mathematics. (Subject 5. First stage.)

Free Drawing. (Second grade art.)

Practical Geometry. (Subject 1.)

Chemistry, inorganic. (Subject 10. First stage.) With practical work.

*Physics.*—Sound, light and heat (Subject 8. First stage), or magnetism and electricity, frictional and voltaic (Subject 9. First stage), or physiography (Subject 23. First stage).

*Second Year.*

Elementary mechanics, including the physical properties of liquids and gases. (Subject 6. First stage.)

*Physics.*—Sound, light and heat (Subject 8. First stage), or magnetism and electricity, frictional and voltaic (Subject 9. First stage), or physiography (Subject 23. Second stage).

Mathematics. (Second stage, and, if possible, Fourth stage. Subject 5.)

Practical Geometry (plane and solid). (Subject 1.)

Chemistry, inorganic. (Subject 10. Second stage). With practical work.

Animal physiology (if possible). (Subject 14. First stage).

Instruction in the subjects of the second year must be kept distinct from that in those of the first year. The student should also, if possible, during the first and second years, work at mechanical drawing, as provided for in the third year.

Special application should be made in case any slight modifications in the course are desired, and they will be considered on their merits.

### *Third Year.*

The work of this year must depend so much on the student's aptitude, and the progress he has made in the preceding course, that it is impossible to lay down the subjects for this course with any definiteness. It is essential that, before continuing his course, or commencing new subjects, he should have a sound knowledge of the first stage of mathematics, elementary mechanics, physics and chemistry; that he should have such a knowledge of practical geometry and mechanical drawing as to be able to draw and read simple plans, elevations and sections with readiness, and that he should have sufficient facility in free-hand drawing to make clear and neat explanatory diagrams.

When these subjects have been mastered, the student should, while continuing his studies in mathematics, take up the first stage of animal physiology, if he has not already done so. He will then be in a position to specialize his studies, with advantage, in one of the following groups, according to his requirements, taking up, for instance:

- (1) Physics and chemistry and metallurgy.
- (2) Theoretical and applied mechanics, steam and machine construction, and drawing.
- (3) Theoretical and applied mechanics, and building construction and drawing.
- (4) Biology.
- (5) Physiography, geology, mineralogy and mining.

The student may also, with advantage, continue his free-hand drawing and practical geometry.

This course has been arranged to lay the foundation of a thorough and systematic scientific training; and while certain subjects have necessarily been omitted, yet it does not follow, on this account, that they are considered unimportant.

Thus systematic botany will be found of very great use as a preliminary to the study of natural science, and as such it may be taught in elementary schools before this course is commenced, but otherwise it cannot be considered a step in a systematic course till the student takes it up as a portion of biology in his third year.

In reference to the privileges allowed to teachers, it may be stated that arrangements are made to enable a certain number of science-teachers to attend courses of instruction in science in the Normal School at South Kensington, in the months of June, July, August and September; also, a limited number of teachers, and of students in science classes, who intend to become science-teachers, are admitted free to the sessional courses of instruction in the Normal School of Science. Science-teachers are sometimes sent abroad, and travel in the service of the Department; certain special grants, railway fares, etc., are always allowed in all these cases.

Facilities are given to science-teachers to bring their students to the Museum to examine the collections.

The Normal School of Science at South Kensington is supported by the state, and is intended to supply systematic instruction in the various branches of physical science to students of all classes. While it is primarily intended for the instruction of teachers and of students of the industrial classes, selected by competition in the examinations of the Department of Science and Art, other students are admitted, so far as there may be accommodation for them, on the payment of fees fixed at a scale sufficiently high to prevent undue competition with institutions which do not receive state aid.

The instruction is arranged in such a manner as to give a thorough training in the general principles of science, fol-

lowed by advanced instruction in one or more special branches. A "Certificate of Associateship" is granted in certain divisions or lines of study, to those who go through any one of those in the prescribed order and pass the necessary examinations. The Royal School of Mines is affiliated to the Normal School, and students entering for the "Associateship" of the School of Mines, obtain their general scientific training in the Normal School of Science. Students who are not candidates for the associateship are permitted to take up the course of instruction in one or more special branches of science, and on passing the examination they receive certificates to that effect.

The associateship of the Normal School of Science is given in one or more of the following divisions:

- (I)—Mechanics,
- (II)—Physics,
- (III)—Chemistry,
- (IV)—Biology,
- (V)—Geology,
- (VI)—Agriculture,

and the associateship of the Royal School of Mines in:

- (VII)—Metallurgy,
- (VIII)—Mining.

The session is divided into two terms, the first beginning about the 4th of October and ending about the middle of February, while the second begins with the middle of February and ends about the middle of June.

The course of instruction which lasts for three years, is the same for all the divisions for the first year, after which it is specialized in accordance with the following scheme:

*First Year.*

*All Divisions.*

*First Term.*  
Chemistry. (Part 1.)

*Second Term.*  
Physics. (Part 1.)  
Elements of Astronomy.

Mathematics and free-hand drawing throughout each term.



*Second Year.*

<i>First Term.</i>	<i>Second Term.</i>
A.—Mechanics and mechanical drawing. (Part 1.)	Elementary geology and mineralogy.

B.—Elementary biology.

A.—For students who take associateship in Divisions I, II, III, VII or VIII.

B.—For those who take the associateship in Divisions IV, V, VI.

Instruction in mathematics so far as may be necessary, and the geometrical drawing throughout both terms.

*Third Year.*

*I.—Mechanics*

<i>First Term.</i>	<i>Second Term.</i>
Mechanics. (Part 2.)	Mechanics. (Part 3.)
Mathematics.	Mathematics.
Machine drawing.	Machine drawing.

*II.—Physics.*

Physics. (Part 2.)	Physics. (Part 3.)
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*III.—Chemistry.*

Chemistry. (Part 2.)	Chemistry. (Part 3.)
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*IV.—Biology.*

A.—Zoölogy. (Part 2.)	Zoölogy. (Part 2.)
B.—Botany. (Part 3.)	Botany. (Part 3.)

*V.—Geology.*

Geology. (Part 2.)	Geology. (Part 3.)
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*VI.—Agriculture.*

Mechanics. (Part 1.)	Agricultural Chemistry.
Principles of Agriculture.	

*VII.—Metallurgy.*

Metallurgy. (Part 1.)	Metallurgy. (Part 2.)
Assaying.	Assaying.

## VIII.—Mining.

First Term.

Second Term.

Mining.

Mining until lectures are completed.

Metallurgy.

Surveying, plan-drawing.

Three courses of evening lectures for workingmen are given during the session, in mining, astronomy and botany, the charge for admission to each course being sixpence.

[To be continued.]

NOTES FROM THE PARIS EXHIBITION.

*Thomson's Electric Welding.*—The following table gives some data regarding the power used in a number of welds and some deductions made therefrom by the writer, which may be of interest. The welds were made with wrought-iron bars; the energy was that delivered to the primary coil of the transformer; the potential was measured at the weld, and the current was calculated from the energy in the primary and the potential, allowing about 90 per cent. efficiency of the transformer.

Diameter of wrought-iron bar in inches, . . . . .	2	2	2	1	1	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
Kilowatts in the primary, . .	61.6	52.8	31.2	13	12.4	7.8	7.5	4.1	3.5
Time in seconds, . . . . .	50	58	144	43	44	33	35	18	21
Units of heat consumed, . .	2,900	2,900	4,300	530	520	250	250	70	70
Potential at the weld in volts, . . . . .	2.06	1.98	1.74	1.51	1.74	1.46	1.52	1.16	1.12
Current through the weld in amperes, . . . . .	27,000	24,000	16,000	7,750	6,400	4,800	4,500	3,200	2,800

It need hardly be added that the exhibit of the Thomson welding machinery in operation, attracted probably more attention among both technical persons and the general public than any other electrical exhibit. This process represented one of the very few recent developments in electricity, of an important character in an entirely new direction.