

which are insulated from it. The resistance in series with these discs is a metallic one, and obviates the trouble usually due to high resistances of graphite or carborundum.

The first spark-gap is adjustable, and is enclosed in a glass cylinder. Six or more sets of spark-gaps are connected in parallel—each through a high-tension fuse—to a common disc, which acts as one pole, while the cast-iron base to which the columns are bolted acts as the other pole. The columns are protected from dust and damage by a glass cylinder, which rests on rubber pads on the cast-iron base, and is protected on top by an insulated cover.

The characteristics of the electric valve may be summed up as follows:—(1) absolute prevention of high-frequency currents; (2) unlimited capacity for dealing with any energy; (3) the adjustable spark-gaps being enclosed in glass cylinders, there is no likelihood of dust getting between the knobs and causing premature action of the apparatus; (4) the automatic extinction of the arc; (5) erection or dismounting very rapid.

The Moscicki condenser resembles an extremely long Leyden jar, with the difference that the neck of the jar—where the coatings end—is considerably thickened. The coatings are produced by a chemical silvering process, and a heavy deposit on both the inside and outside of the jar is obtained, which is further strengthened and protected by a copper deposit. The jars are then mounted in a tin or brass tube, on the top of which a high-tension insulator is arranged, and carries the contact connected to the inner coating. The outer coating is connected to the metal tube, and the intermediate space is filled with a mixture of glycerin and water. It is then hermetically sealed, and consequently the condenser can be used in any position. Glass is used for the dielectric, owing to its great dielectric capacity and uniformity.

The usual type of condenser as used for line protection consists of a number of tubes, as described above, mounted on a wrought-iron frame, and the inner coatings are connected in parallel through high-tension fuses to a common terminal, to which the line is connected. The outer coatings are connected to the tin or brass tubes, and connected to earth by means of the framework, which is so arranged that each tube can be easily replaced or removed when it is necessary.

The design and action of both the electric valve and the Moscicki condensers are clearly explained in a pamphlet issued by Messrs. Isenthal and Co., of 85 Mortimer Street, W., who have acquired the patent rights for both these forms of apparatus for this country and the colonies.

#### EDUCATION DURING ADOLESCENCE.<sup>1</sup>

FOR the vast majority of English boys and girls, our system of national education is a torso. It ends too soon. It is a trunk without a head. How to remedy this defect with practical wisdom, without expenditure so immense as to provoke reaction, and with the convinced cooperation of enlightened employers of labour, and of all parents who unselfishly desire to further the best interests of their children, is becoming one of the pressing questions of the day.

Out of some 1,300,000 boys and girls in England and Wales who are between twelve and fourteen years of age there are (to the best of our knowledge) about 211,000 (in addition to partial exemption scholars) who have already obtained exemption from attendance at school, and are receiving no further systematic education. Out of the two million young people in England and Wales who have passed their fourteenth birthday, but are still under seventeen years of age, only one in four (so far as our knowledge goes) receives on week days any continued education. "The result" (I quote the finding of the Consultative Committee) "is a tragic waste of early promise. Through lack of technical training, hundreds of thousands of young people fail to acquire the self-adaptiveness and dexterity in handicraft which would enable them to rise to the higher levels of skilled employment. Through lack of suitable physical training, their bodily powers are in-

sufficiently developed, and their self-control impaired. Through lack of general training, their mental outlook remains narrow, their sympathies uncultivated, their capacity for cooperation in civic welfare stunted and untrained. In the meantime, modern industry, in some of its developments, is exploiting boy and girl labour during the years of adolescence. An increasing number of 'blind-alley' employments tempt boys and girls, at the close of their day-school course, by relatively high rates of wages which furnish opportunities of too early independence, but give no promise of permanent occupation and weaken the ties of parental control."

The present state of things is not only intellectually and economically wasteful, but often morally mischievous. City life enhances the danger. Unskilled, or relatively unskilled, employment at thirteen, with good money, tempts a boy (and an increasing number of girls) like a baited trap. A lad is drawn into a way of life which leaves him at sixteen or seventeen without a trade to his fingers, and with the habit of steady learning clean gone out of his head. The years between thirteen and sixteen or seventeen are the years of educational leakage. We are like people who have laid down a costly system of water supply, but have left a badly leaking pipe just behind the tap. In order that our system of national education for the masses of the people may bear better fruit in personal skill and in civic value, the time has come for us to secure a better foundation in the elementary day schools and the continuance of wise educational attendance during the years of adolescence.

Differ as we may in judgment as to the legislative treatment of the problem, we find, I think, but little disagreement among ourselves in educational aim. Do we not virtually concur in thinking that all boys and girls ought to receive, during the years of adolescence, some form of continued education which will develop their physique, widen their mental outlook, cultivate their sympathies, prepare them for the responsibilities of parenthood, equip them for trustworthy efficiency in the occupation by which they will earn their livelihood, and fit them for the duties of citizenship? If this is to be done, it will be necessary to mortise the work of the day and evening technical classes into the work of the elementary day schools. We need in the latter more training of the hand and of the constructive powers, not with any prematurely technical purpose, but as a necessary factor in brain development and in a liberal education. This will not be possible unless we have smaller classes in the elementary day schools and unless the course of training for teachers can be so prolonged as to permit training in educational hand-work to be included in their course of professional preparation without congestion of studies, without over-pressure of mind, without encroachment upon the indispensable liberal education, and without undue curtailment of that mental leisure which is needed for all healthy growth of interest, originality, and purpose. Nor do we conceive of the technical class, whether day or evening, as purely utilitarian or technological. Direct bearing upon subsequent employment or occupation it must have. But inseparable from its true educational influence is careful regard for the training of the body, for the cultivation of the sympathies and of the imagination by the love of literature, by music and by art, for an opening of the mind to the significance of civic responsibility, and also for those influences (often most powerful when least expressed in words) which help in forming a purposeful, steadfast, and disinterested character.

It is because the people's high schools in Denmark have not only aspired to these aims, but have largely achieved them, that they have raised the level of culture in the whole nation and have indirectly, and, as it were, in by-product, enhanced the economic welfare of the people. Nor should it be forgotten that the Danish high schools do not receive children during the years immediately following the day-school course, but are confined to pupils above sixteen years of age. For this reason, the Danish high schools are not at present fully grappling with the problem of how best to continue the education of urban children; but the record and success of these schools may well make us hesitate before embracing the conclusion that, for children in the agricultural districts, attendance

<sup>1</sup> From a paper on "The Relation of Elementary Schools to Technical Schools—Day and Evening," read at the North of England Education Conference, Leeds, on January 7, by Prof. M. E. Sadler.

at a continuation class between fourteen and sixteen is the only, or indeed the best, way of securing the kind of further education most fitted to their needs.

Many of the statements now current as to the universality of compulsory attendance at continuation schools in different parts of Germany seem to me unintentionally misleading. After persistent efforts, and with the help of some of the best informed of German educators, I have failed to obtain any comprehensive statistical statement showing the number of boys and girls between fourteen and seventeen years of age in different parts of the German Empire who are actually attending continuation schools. Where I have been able to test such figures as are published, I have been drawn to the conclusion that the enforcement of compulsion, even in those parts of Germany where compulsion is statutory, is less general than the wording of the statutes would lead us to expect. The whole subject calls for closer investigation. There is some reason to think that, even in the progressive parts of Germany (and there are large regions in which education is the reverse of progressive), the problem of securing continued education for the majority of girls, and also for those boys who are not intending to enter a skilled trade, is still far from having been effectively solved. We in England have indeed much to learn from Germany and from some of the cantons of Switzerland, but it is right to remember that, for historical reasons which are far from discreditable to us, we have approached the problem from the point of view of the individual rather than from the point of view of the State. I can find no country in which the voluntary attendance at evening classes is so large in proportion to the adult population as it is in England and Wales. I would venture to urge that our task is so to use the collective power of the State as to stimulate, but not to supersede, the energy and forethought of the individual. Bureaucratic collectivism in education seems to me as false an ideal as, at the opposite extreme, is chaotic and plunging individualism. We need a synthesis between the individual energy of the pupil, the responsibility of the parent, the responsibility of the employer, and the watchful supervision, the financial aid, and the uplifting public purpose of the local authority and of the State. Nor, in this matter of continued education, should we allow ourselves to attach too much importance to academic standards of attainment or of theoretical knowledge. Much of the best education in the world is remote from the class-room.

In England, the difficulties which we find in the way of bringing the elementary schools into closer and more fruitful relation to a stimulating kind of further and largely technical education are partly psychological, partly administrative, partly economic.

A great number of English employers and foremen are lacking in insight into the true meaning and value of education, and also often fail to discharge their moral responsibilities for the further education of the young people in their employment or under their care. Nothing strikes me so much in comparing a German industrial city with an English as the keener interest on the part of the mass of German employers in educational questions, and especially in the educational aspect of the daily duties of the workshop. We in England are apt to forget that education is really an aspect of life, and that every skilled adult may find one of his keenest pleasures in imparting a right attitude of mind and a sense of skill and finish to the young people growing up under his care. These things are partly traditional in a nation, and the unbroken tradition of skilled workmanship which has survived from the Middle Ages to the present day in many of the older German cities is one cause of the German attitude of mind towards industrial and technical training. With us the industrial revolution, which introduced the factory system (great as that achievement was from many points of view), snapped an ancient tradition (which already was half dead) and purposely re-started industry in new places where the old tradition had never grown. The first step towards the diffusion of a deeper insight into the value of education is the extension of a liberal, non-pedantic, non-examination-ridden, secondary education accessible, not only to the employing class, but to those who will rise to be foremen and thus hold re-

sponsible, though subordinate, posts in industry and commerce. When a man has himself had at school an education which has affected his whole life, he is more ready to understand the importance of securing a similarly suitable education for other people.

It is idle to deny that a comprehensive system of continued education during adolescence, (the kind of system which the country really needs and without which much of its present expenditure runs wastefully into the sand) will be a very costly thing to provide and maintain. On the Consultative Committee we tried to form an honest estimate of the cost. We came to the conclusion that a system of compulsory attendance at continuation schools of all young persons between fourteen and seventeen years of age would, if universally applied in a satisfactory manner, involve for maintenance alone an additional annual expenditure of two and a half million pounds. For my own part, I believe that if the work in continuation schools were made (as it should be made) thoroughly practical, the cost would be considerably greater.

Every month given to the further study of the subject which we are met to discuss impresses upon us more deeply the range and social complexity of the issues which necessarily arise, in this country and elsewhere, whenever the problem of continuation schools is seriously approached. The better adaptation of technical schools, day and evening, to the public elementary-school system involves something far beyond skilful administration on the part of the local authorities, and is on a quite different plane of difficulty from that of previous proposals for the raising of the school age. It would be misleading to discuss the subject with our attention confined to narrow technicalities or administrative details, necessary as those are to the right solution of our difficulties. On the whole, as it seems to me, we have just reason for encouragement as to the future. There are many signs that the nation is approaching the problem in the right attitude of mind and with willingness fairly to consider temperately stated arguments for reform. The growth of this right attitude of mind is much more important than hurried legislation, which, indeed, if precipitately forced on to the Statute Book, would retard rather than hasten our advance. English opinion ripens slowly, but I believe that ultimately it will regard as a social necessity the continued education of young people during adolescence under conditions which will protect them from overwork of body and mind. In the meantime, the Scottish experiment is full of significance for us. The foundations of an effective continuation-school system must be laid through a change in the conditions of attendance and study in the elementary schools. Our primary need is a raising of the normal age for exemption from day-school attendance to the limit adopted in Scotland since 1901. Further, is not the time ripe for imposing on every local authority the statutory duty of making suitable provision of continuation classes for the further education of young persons resident in their district from the time they leave the day school up to their seventeenth birthday, and of keeping a register of all such young persons with a record of their occupations? In order that this duty may be rightly discharged, it appears to me indispensable that the Parliamentary grant in aid of continuation schools should be materially enlarged. Without such aid the poorer districts in town and country will not be able to support the expense of providing instruction sufficiently practical or teachers adequate to the task of imparting it. In this particular grade of education the schools must necessarily compete with industry and with commerce for the services of those who are really competent to teach what the pupils will most require to learn.

With the growth of public confidence in their fair-mindedness and educational insight, the local authorities will acquire that moral authority which will alone enable them to exercise the power, almost certain in the end to be entrusted to them by statute, of prescribing the limit of hours of work which no young person under the age of seventeen may exceed in any day or week in employment and systematic education combined; but in order to secure in an effective way physical, technical, and civic training for all young people during the years immediately following the close of the day-school course, two other

statutory changes seem to me to be necessary. First, it should be lawful for the education authority of any county or county borough to make bye-laws (subject to confirmation by the Board of Education) for requiring the attendance at continuation classes up to any age not exceeding seventeen years of any young persons resident or working in their district and not otherwise receiving a suitable education. Secondly, Parliament should make it the statutory duty of every employer of any young person under seventeen years of age (a) to enable him or her to attend continuation classes for such period of time and at such hours as may be required by the bye-laws of the local education authority of the district in which such young person either works or resides, and (b) to supply the names of all such young persons to the local authority on its demand; and, in order to secure the regular attendance of pupils at technical and other continuation classes in areas where such attendance is made compulsory by bye-law, all employers in such trades or parts of the district as the bye-law may specify should be forbidden, under penalty, to employ any young person under seventeen years of age who fails periodically to produce a card attesting his or her attendance at continuation classes in conformity with the terms of the local bye-law.

These are the central and fundamental recommendations unanimously made by the Consultative Committee of the Board of Education. They are so designed as to stimulate individual energy within the necessary framework of administrative unity.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A POST-GRADUATE course of seven lectures on "Photoclectricity" will be given at King's College (University of London) during the Lent term, by Dr. H. Stanley Allen, on Wednesdays, at 5 p.m., beginning on January 19. These lectures are open without fee to internal students of the University on production of a card of admission from their college.

It is stated in *Science* that Mr. Henry Phipps, of New York, founder of the Phipps Institute in Philadelphia, has presented to the University of Pennsylvania the sum of 100,000*l.*, to be used in the campaign against tuberculosis. Six years ago Mr. Phipps founded the Phipps Institute for Tuberculosis Research in Philadelphia, with a large endowment. In 1908 he gave 100,000*l.* to the Johns Hopkins University for the founding of a psychiatric clinic. From the same source we learn that the eleventh industrial fellowship at the University of Kansas has been established by the Pacific Coast Borax Company, of Oakland, California, and will be known as the Borax fellowship. The amount which this company will pay to support the work of its fellow is 150*l.*

We learn from the *Pioneer Mail* that the Government of Bombay, in a letter to the University Senate, says the offers of contributions which have been made by the leading citizens render it possible to begin the establishment of a central institute in Bombay for the teaching of science. Such an institute is needed urgently in order that the Presidency may have advantages essential to progress which are now reaped by other countries. Before practical steps can be taken in this direction it is necessary to consider what classes of students should be provided for and how the teaching of science can be blended with the system of higher education under the direction of the University. The Governor in Council, after considering the existing curriculum, concludes that radical changes are necessary if the teaching of science and higher education generally are to be brought into harmony with modern requirements.

THE current issue (No. 29) of the *Transvaal Agricultural Journal* contains an article on the desirability of founding a national college of agriculture for the Transvaal. A million pounds is asked for as an endowment, and it is suggested that the college should be thrown open to all students from the British Empire. Mr. F. B. Smith,

the Director of Agriculture, has repeatedly urged the necessity for a well-organised scheme of agricultural education in South Africa, and has, indeed, already opened a college at Potchefstroom, under Mr. Holm's principalship. A number of letters from distinguished Americans are printed setting forth the great advantages that have accrued in the United States from the elaborate system of agricultural colleges and experiment stations established there. As the Transvaal already possesses one of the best agricultural departments in the British Empire, it seems fitting that it should also possess the greatest agricultural college.

MUCH educational information of interest and importance is to be found in the latest report of the U.S. Commissioner of Education. We notice that attention is directed to the 1908 report of the Prussian Minister of Public Instruction, which gives a list of twenty-six States comprising the German Empire and their relative university attendances. The list makes it clear that south Germany supplies a relatively greater number of students than Prussia and Saxony. This is noteworthy, because the south has many more small shop industries and smaller farms than the north. The proportion of Prussia would be smaller still if Berlin were excluded. Of the thirteen Prussian provinces, nine remain below the Prussian average. Those districts of the north which are chiefly agricultural furnish few university students, while the agricultural districts of the south furnish many more than the Prussian average, and more than the average of the Empire. Among every 10,000 male inhabitants in east and north Germany in 1905-6, 10-90 were attending universities, in middle and west Germany 12-63, and in south Germany 14-25. Whether analogous results would be noticed if the attendance at technological institutes, agricultural colleges, mining schools, and so on were considered cannot be stated with certainty. In a few years the relative attendance will be greatly changed, since Prussia has opened its universities to women.

THE inaugural address of Prof. H. J. Waters on the occasion of his formal installation as president of the Kansas State Agricultural College, Manhattan, is given in a recent number of *Science* (December 3, 1909). Prof. Waters dealt with the development of the agricultural college in America, and pointed out that, as only one out of every four hundred school children ultimately graduates at college, steps must be taken to bring the work of the colleges to the people. The farmers' institutes do splendid work in this direction, bringing no fewer than one-third of the farmers into personal touch with the college representatives, while as soon as funds are forthcoming the experimental work is to be carried into every county in the State. In justification of these proposals he says, in reference to the past methods of management:—"Ours has been a waste of the resources of soil and forest and stream that is without parallel in the history of the world. This waste has been largely due to improper systems of farming, and cannot continue another century without bringing ruin to American basic industry." The new department of public highways at the college will urge the importance of good country roads, and supervise their construction as soon as the money is forthcoming. In plant and animal improvement, also, the college must lead the way, since it alone can carry on a well-planned programme for an indefinite time. The distinct position occupied by the experiment station was well brought out. Its function was to create agricultural knowledge, not simply to benefit the farmer directly, but to make an exact science of agriculture and enable it to be taught successfully in the colleges, schools, farmers' institutes, and on demonstration farms. Lastly, the rural school problem was dealt with, and this seems to be as far from a satisfactory solution in America as it is here. Not only is there a lack of suitably trained teachers, but, so far, no satisfactory scheme of working the school has been devised. The address is highly suggestive.

THE Education Department of the London County Council has circulated particulars of the science and technology scholarships and exhibitions which are open for com-