electrical resistance, and the following extract from Lord Rayleigh's note gives his suggested explanation on the supposition that the metals in an alloy are arranged in laminæ, and that the current flows across the laminæ.

"According to the discovery of Peltier, when an electric current flows from one metal to another there is a development or absorption of heat at the junction. The temperature disturbance thus arising increases until the conduction of heat through the laminæ balances the Peltier effect at the junctions, and it gives rise to a thermo-electromotive force opposing the passage of the current. Inasmuch as the difference of temperature at the alternate junctions is itself proportional to the current, so is also the reverse electromotive force thereby called into play. Now a reverse electromotive force proportional to current is indistinguishable experimentally from a *resistance;* so that the combination of laminated conductors exhibits a false resistance, having (so far as is known) nothing in common with the real resistance of the metals."

The structure of eutectic alloys seems to have a special bearing on this question, and seems to afford strong support to the view suggested by Lord Rayleigh. Guthrie pointed out in 1884 that the particular alloy of two metals possessing the lowest freezing point of any alloy of the two that can be made, and which he called the eutectic, is analogous to a cryohydrate, the cryohydrates being regarded as eutectics of ice and the particular salts employed.

FIG. 1.—Silver-lead eutectic, × 100. Oblique illumination.

As Prof. Roberts-Austen in his valuable Cantor Lectures on Alloys (delivered March–April 1897) has pointed out, the analogy between cryohydrates, eutectic alloys and the pearlite of steels is now completely established. The elaborate microscopical investigations of steel and of eutectic alloys made by Osmond, Charpy, Stead and others, together with the work of Ponsot on the cryohydrates, reveal the presence in each case of two different constituents arranged in microscopic laminæ. In the case of the cryohydrates the two constituents are ice and the salt, in eutectic alloys they are the constituent metals, and in the pearlite of steels they consist of alternate layers of pure iron and iron carbide.

In connection with an investigation of the micro-structure of silver-lead alloys the writer has had occasion to examine the eutectic of these two metals, an alloy containing about 2·8 per cent. of silver, and the accompanying photographs of this convey an excellent idea of the structure of eutectic alloys in general.

Fig. 1 shows the appearance presented by a polished surface of a section of this alloy after etching for several hours with acetic acid at the ordinary temperature. The lead has partially dissolved, exposing the silver in bright plates, the edges of which, a good deal bent over and distorted by the action of the stream of wash water, are presented to the observer. A section cut at right angles to the one figured, which is cut parallel to the cooling surface, presents a similar appearance.

By acting on a portion of this alloy with the vapour of hot acetic acid for several weeks the lead was wholly dissolved, and the bright plates were separated and examined. They proved to be pure silver. They are translucent, the light transmitted through them being violet or greyish violet. Some of these plates were mounted in balsam, and Fig. 2 is reproduced from a photograph of one such preparation taken with a $\frac{1}{12}$" oil immersion objective. Measurements of a number of plates which happened to be lying on edge showed that their thickness was less than $\frac{1}{6000}$ of an inch, but accurate measurements in this way are not possible owing to the "black and white dot" effect well known to microscopists.

As will be seen from the figure, the plates exhibit distinct cleavage at angles of 60° or 120° to their longer axes. Some of them are seen to be crossed by a series of faint markings at these angles, markings bearing a very curious resemblance to those obtained by Commander Hartmann by subjecting metallic plates to compressional or torsional strain (Hartmann: "Distribution des déformations dans les métaux soumis a des efforts," Figs. 21 and 173, pp. 25 and 175). It is difficult to avoid the conclusion that they have a similar origin, the strain in this case being probably due to the shrinkage of the alloy on solidification or on subsequent cooling. A distinct folding or crumpling of the plate can be seen in the photograph, showing that in spite of their pronounced directions of cleavage the plates are not excessively brittle.

The bearing of this structure of an alloy on Lord Rayleigh's remarks will be readily understood. The greater number of alloys which have been subjected to tests of their electrical resistance are *partially* made up of the eutectic of their constituents, the remainder of the alloy consisting of one of the two metals or of a compound of the two. It is not conceivable that the work done in rolling and wire-drawing, though it may cause some splitting up of the plates in the eutectic, should entirely destroy this laminated structure; and its existence would almost certainly give rise to the thermo-electric effects which may be the cause of the abnormal resistance of many alloys compared with that of the metals of which they are composed.

SAVILLE SHAW.

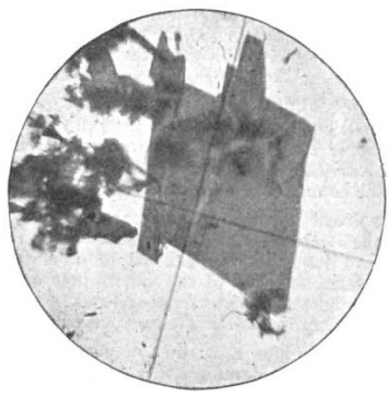

FIG. 2.—Eutectic silver plate, ×

THE BOARD OF EDUCATION BILL.

THE following are the clauses of the Bill introduced by the Duke of Devonshire in the House of Lords last week, and having for its object the establishment of a Board of Education for England and Wales.

I.—(1) There shall be established a Board of Education charged with the superintendence of matters relating to education in England and Wales.

(2) The Board shall consist of the Lord President of the Council, Her Majesty's Principal Secretaries of State, the First Commissioner of Her Majesty's Treasury, the Chancellor of Her Majesty's Exchequer, and one other person appointed by Her Majesty the Queen and holding office during Her Majesty's pleasure, and it shall be lawful for Her Majesty to appoint a

President, and, if he is Lord President of the Council, a Vice-President, of the Board.

II.—(1) The Board of Education shall take the place of the Education Department (including the Department of Science and Art), and all enactments and documents shall be construed accordingly; and as from the establishment of the Board of Education the Education Department Act, 1856, shall be repealed.

(2) There shall be exercised by the Board of Education the powers conferred on the Charity Commissioners by any scheme made in pursuance of the Endowed Schools Acts, 1869 to 1889, except that—

(*a*) any power with respect to a question as to the construction of a scheme or other document shall be exercised by the Charity Commissioners; and

(*b*) any power with respect to the control or management of property forming the capital of any endowment, shall be exercised by the Charity Commissioners with the concurrence of the Board of Education;

and for this purpose the powers exercisable by the Charity Commissioners under the enactments mentioned in the schedule may also be exercised by the Board of Education.

(3) The Charity Commissioners shall, in framing schemes in pursuance of the Endowed Schools Acts, 1869 to 1889, act in consultation with the Board of Education, and shall frame a scheme under those Acts if so requested by the Board.

(4) In addition to any powers exercisable under this section or otherwise, the Board of Education may, by their officers, visit, inspect, and examine any school, and give certificates in respect of the teaching therein, whether the school is subject to the Charitable Trusts Acts or the Endowed Schools Acts, or not. Provided that, in the case of a school not so subject, the power conferred by this sub-section shall be exercised only with the consent of the governing body of the school.

III.—It shall be lawful for Her Majesty in Council from time to time, by order, to appoint a consultative committee for the purpose of advising the Board of Education on any matter referred to the committee by the Board.

IV.—The Board of Education may appoint such officers and servants as the Board may, with the sanction of the Treasury, determine, and there shall be paid, out of moneys provided by Parliament, to any member of the Board not holding another salaried office, and to the officers and servants of the Board, such salaries or remuneration as the Treasury may determine.

V.—(1) The Board of Education may sue and be sued and may for all purposes be described by that name.

(2) The Board shall have an official seal, which shall be officially and judicially noticed, and that seal shall be authenticated by the signature of the President or some member of the Board, or of a secretary, or of some person authorised by the President or some member of the Board to act on behalf of a secretary.

(3) Every document purporting to be an instrument issued by the Board of Education, and to be sealed with the seal of the Board, authenticated in manner provided by this Act, or to be signed by a secretary or any person authorised by the President or some member of the Board to act on behalf of a secretary, shall be received in evidence and be deemed to be such an instrument without further proof, unless the contrary is shown.

(4) A certificate signed by the President or any member of the Board of Education that any instrument purporting to be made or issued by the President or some member of the Board is so made or issued shall be conclusive evidence of the fact.

VI. The President or Vice-President of the Board of Education shall be capable of being elected to, and of voting in, the Commons House of Parliament, and the offices of President and Vice-President of the Board of Education shall be deemed to be offices included in Schedule H. of the Representation of the People Act, 1867; in Schedule H. of the Representation of the People (Scotland) Act, 1868; in Schedule E. of the Representation of the People (Ireland) Act, 1868; and in Part I. of the Schedule of the Promissory Oaths Act, 1868.

VII.—(1) This Act shall not extend to Scotland or Ireland.

(2) This Act may be cited as the Board of Education Act, 1898.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. D. K. MORRIS has been appointed lecturer on technical electricity in the Mason University College, Birmingham.

MR. J. J. FINDLAY, Principal of the Training Department of the College of Preceptors, has been appointed head master of the Cardiff Intermediate School.

THE following appointments to posts in University College, Sheffield, have recently been made:—Lecturer in physiology: Mr. C. F. Myers-Ward, of the Owens College, Manchester. Assistant lecturer in mathematics: Mr. G. St. L. Carson, late Fellow of Trinity College, Cambridge. Assistant lecturer and demonstrator of physics: Mr. Albert Griffiths, of the Owens College, Manchester.

"UNIVERSITY reform," on which so much public attention is now concentrated in this country, would appear to be a no less burning question in Italy, to judge from the opinions expressed by Prof. C. Ferrini in the *Rendiconti del R. Istituto Lombardo*, xxxi. 11-12. The principal evil of the Italian University system at the present time would appear to be the large and ever-increasing body of ill-prepared students swarming into university classes, many of whom possess little or no aptitude for study. This results in a lowering of the standard of teaching, the effects of which are already making themselves shown, and the supply of graduates seeking employment in the learned professions is largely in excess of the demand. Prof. Ferrini considers the most feasible remedy to be a raising of the fees charged for admission to university courses. Any funds arising from this increase might, of course, be devoted to the furtherance of advanced work, but the main object in view would be to exclude idle and incompetent students from the class rooms, and to stimulate those who entered on the curriculum to make better use of their opportunities, with, moreover, better prospects of obtaining employment afterwards in a less overcrowded market. Having had nearly equal experience of German and Italian universities, Prof. Ferrini considers that the introduction of the German system into Italy could only lead to pernicious results, the principal reason being the great difference in the preparation provided in the two countries for lads before they enter college.

THE London Technical Education Board have arranged for the Session 1898-99 a number of evening science classes, and Saturday morning classes for teachers, in conjunction with University College, King's College, and Bedford College. At University College, Profs. Hudson Beare, Fleming, and Ramsay will between them deliver a course of twelve lectures upon the principles of chemical technology. The lectures will deal with the generation of power and its cost, the generation of electric currents and their application in electro-chemical processes, and the chemistry of the various processes now adopted. Prof. Fleming will also give a course of lectures upon electrical measurements, and Prof. Hudson Beare a course on mechanical engineering. At King's College, evening courses of lectures will be delivered by Prof. Robinson on civil engineering, Prof. Banister Fletcher on architecture, and Prof. Grylls Adams on physics. These courses of instruction will afford an opportunity to students who can study only in the evenings to obtain instruction in well-equipped University laboratories, and will make available to evening students the same advantages as are enjoyed by University day students, but they are only intended for those who are practically engaged during the day in some trade, business, or occupation.

Saturday morning classes have been arranged by the London Technical Education Board for teachers. At King's College, a course of about ten lectures will be given by Prof. Hudson, on the teaching of elementary mathematics. The object of these lectures is to help those who are practically engaged in teaching, and wish to become acquainted with modern mothods and improvements in order to render their teaching more effective. A course of about fifteen lectures on heat engines and general laboratory work will be delivered by Prof. Capper. The object of the course is to acquaint teachers with modern methods of teaching the subject, and to illustrate the use and preparation of laboratory apparatus for demonstration. At University College, a course of ten lectures will be given by Prof. Fleming, on magnets and electric currents. The object of the course is to give instruction in modern methods of science teaching. It will consist in the delivery by the professor