were graduated. In the United States alone, in 1882–83, out of every 1,000 matriculates, 331 were graduated, while in 1886–87 only 305 out of every 1,000 matriculates were graduated.

THE FUTURE OF MEDICAL GRADUATES. — Of some one thousand graduates from collegiate institutions, says the *Pacific Record*, seventy-five only make for themselves a name and prominence in their calling. About two hundred, having business qualifications, become rich by their practice and by judicious investments. Four hundred abandon, in whole or in part, their profession for some more lucrative business; and the balance struggle with mediocre ability for a bare subsistence, and a wearying effort to keep up an appearance before the people.

ALCOHOL AND FEVERS. — Dr. Kretzschmar of Brooklyn read a paper at the recent meeting in Albany of the New York Medical Society, on the use of alcohol in certain forms of fever. He believed that in some diseases alcohol, if properly administered, was not only instrumental in prolonging life, but was frequently a most potent factor in preserving it. Alcohol possesses the qualities of both food and medicine. It is one of the best antiseptics, and the most reliable remedy we have in the treatment of diphtheria. He regarded alcohol as beneficial in the treatment of phthisis, especially when the temperature of the patient was increased. In the discussion which followed, Dr. Castle advised that stimulants be kept in several small bottles, as, when exposed to the air, they lost valuable medicinal properties.

BOVINE TUBERCULOSIS. — Dr. Brush of Mount Vernon discussed at the Albany meeting the subject of bovine tuberculosis. Of all domesticated animals, the bovines are the most subject to tuberculosis. Five per cent of the cattle in England are affected with tuberculosis, and it is said that twenty per cent of the cattle in some of the thoroughbred Jersey herds in the Northern States are similarly affected. He believed that more human beings were not infected, because the normal temperature of the human race was so much lower than that of the bovine, — 98.5°F. in the one, and 101° to 103° F. in the other; this latter temperature being necessary for the growth of the germ of the disease. The cultivation of tuberculosis in animals confirms this view, as resistance to the disease decreased as the normal temperature of the animal increased. Thus, in the dog, resistance was good, while in the common fowl it was *nil*. Dr. Brush thought that the Federal Government would do better to spend its money in the investigation and suppression of this disease, than to appropriate five hundred thousand dollars to stamp out pleuro-pneumonia, which did not affect the human race. He believed, that, if bovine tuberculosis were eradicated, it would soon become eliminated from the human race, and he thought that physicians should strive to procure laws which would accomplish this.

ELECTRICAL SCIENCE.

Secondary Batteries.

IT has been for many years the dream of inventors to perfect some apparatus by which energy could be stored, to be used when occasion required. The secondary battery accomplishes this better than any thing else that has been invented, but it has limitations and defects that it is well to point out.

The two principal uses, with a great number of minor applications, to which secondary batteries can be put at present, are the distribution of energy for electric lighting, and their use in driving street-cars. As for the first of these, it is well known that the direct system of constant potential distribution cannot be employed at any considerable distance from the central station, owing to the heavy investment in copper necessary. If storage-batteries could be economically used, however, they could be distributed at different points through the district, to be lighted and charged by a high potential current, allowing comparatively small conductors to be used, and employing the electric plant during the day, when it would otherwise be idle.

The advantages for street-car work are apparent: each car carries within itself the energy necessary for running it; a break-down of one car does not affect the rest of the system. Compared with other electrical systems, the advantages are, that it can be used in crowded streets with no danger from high potential currents; and where a large number of cars are used, it is much simpler than any other plan. Compared with cables, it gives a greater economy of power, a less first cost, and the impossibility of one accident disabling the whole line.

The disadvantages of secondary batteries are the cost, the waste of energy, the deterioration, and the weight for a given capacity and rate of discharge.

The type of storage-cell most generally in use is some modification of the Faure cell, generally of the Faure-Sellon-Volkmar type. In it the plates are made of cast lead supports or 'grids,' into which is pasted a mixture of red lead and sulphuric acid. The 'grid' has in it square hour-glass shaped holes, the contraction in the middle being intended to prevent the active material from falling out. The plates pasted with red lead are put into dilute sulphuric acid, alternate plates are connected together, and an electric current is sent between the two sets, changing them into pure lead and lead peroxide. Plates thus 'formed' are put into cells with dilute sulphuric acid, a number of lead or negative plates, and peroxide or positive plates, in each cell. This is, very briefly, the general method of manufacture.

Now, suppose we have one of these cells fully charged, — all of the positive plate peroxide, all of the negative plate lead, — and discharge it through a resistance. At first the electro-motive force is over 2 volts. This will rapidly run down to about 1.95 to 2 volts, where it will remain constant (provided we do not discharge the cell too fast) for a considerable time, when it will begin to fall, and, if we continue the discharge, it will finally become zero. If, now, the plates be analyzed, it will be found that the positive plate has in it peroxide and sulphate of lead, the latter perhaps fifteen to twenty per cent of the whole active material. The negative plate will consist of pure lead and sulphate. If we charge the cell, the plates will be changed to pure lead and peroxide again, the electro-motive force will gradually rise to 2.25 volts, and, when the charge is nearly complete, oxygen will be given off from the positive plate. There are two very important things to be noticed. If we charge and discharge the cell a number of times, we will find that the energy we get out of the cell is less than the energy we put in by an amount that varies with the rate of discharge, the efficiency being less as the discharge rate is greater: the average efficiency for the present storage-cell is something near seventy per cent. Another point even more important than the first is, that, if we greatly increase the discharge rate, the electro-motive force of the cell will fall rapidly; and if we persist in this, the plates will corrode and buckle, and the plugs of active material will fall out of the holes in the plates. There is one more disadvantage besides these, and that is the fact that the life of the cell, especially that of the positive plates, is limited. Under favorable conditions, the positive plates will last, on the average, two years: the negative plates will last much longer.

For lighting, the most important disadvantages are the cost, the loss of energy, and the deterioration. The fact that the cells cannot be discharged at more than a certain rate does not greatly affect their usefulness in ordinary cases. And storage-batteries have reached such a state of development that it is safe to say, that, if they were sold and repaired at reasonable prices, they would have at once a great field of usefulness for electric lighting, even with their present defects. The principal cost of a storage-cell is for material: the cost of the labor is comparatively small, and, when the plates have given out, at least a part of the material is left.

But for traction-work the greatest disadvantage is in the slow discharge rate permissible. At present from three thousand to four thousand pounds of storage-batteries are required to drive an ordinary car, the storage capacity being enough for a run of from forty to sixty miles. This great weight increases the power necessary to run the car, the wear of the track, and the deterioration of the car. Besides, it means a considerable first investment, and a large battery to be kept in repair. If we could discharge the battery at any rate we wished, we could make a round trip with seven hundred and fifty to one thousand pounds of battery. We would have to charge our batteries oftener, of course, but we would greatly decrease our items of first cost, depreciation, wear of road-bed and cars, and even of power expended.

It has been variously estimated that the difference of expense be-

tween horses and the storage-battery, including every thing but the deterioration of the battery, is from one to three dollars per car per day in favor of the battery. Taking a well-known form of battery as a type, supposing fifty per cent over the cost of manufacture is charged for the cells, and estimating the cost of horse-power for one of the New York street-railways: the difference of cost of the two systems is roughly two dollars and a half per car per day. Now, whether the repairs of the battery will cost this much is a matter that only experience can settle, but on roads where the grades are slight it is very probable that the batteries will be most economical.

The matter at present stands thus: only about fourteen per cent of the possible storage capacity of storage-cells is utilized; their discharge rate is limited, so that even this comparatively small capacity is great in comparison to it; the cells deteriorate, so that a large item of expense is in repairs; the efficiency of the cells is not greater than seventy per cent. Even with these disadvantages, storage-batteries can be largely applied for lighting and traction-work. It seems impossible, with the number of investigators working on the subject and the great possibility of improvement, that the next few years will not see a great increase in the economy, storage capacity, and discharge rate of storage-cells; and a very moderate increase in any of these, especially the latter, will throw the balance decidedly in their favor for traction-work. For lighting, their field is equally extended.

PRIMARY AND SECONDARY CURRENTS IN INDUCTION-COILS. — The relations between the primary and the induced secondary currents in induction-coils have been investigated mathematically by several writers, the clearest and most satisfactory treatment being probably that of Mascart and Joubert. Since the experiments of Ewing on the magnetization of iron, it has been clear, not only that the assumptions hitherto made have not accurately represented the facts, but that any rigorous mathematical treatment would, with our present knowledge, be impossible. The work of Prof. Galileo Ferraris in this connection is important as showing the extent of the modification that can take place. He has determined experimentally the difference of phase between the primary and secondary currents in an old-type Gaulard and Gibbs transformer, and, comparing them with theoretical deductions of his own, finds the agreement satisfactory. The objections to his work seem to be that the apparatus he experimented on is obsolete, and is not of the type at present universally used; the old transformers having an open magnetic circuit, while now the magnetic circuit is always closed. The work is important, however, as showing the inadequacy of the at present accepted treatment.

ETHNOLOGY.

Notes on the Kwakiool of Vancouver Island.

DR. GEORGE M. DAWSON gives in the Transactions of the Royal Society of Canada for 1887 a very interesting sketch of the Kwakiool, a people inhabiting the central part of the coast of British Columbia. He describes the numerous tribes of this nation and their several villages, but the most interesting part of the paper is a description of their mode of life, traditions, and language. They live in large wooden houses, the front of which is painted with designs representing the fabulous thunder-bird, whales, snakes, or salmon, while the posts and beams supporting the roof are carved in similar forms. The children are for a long time kept tied into the cradle. When they leave it, the cradle and the bedding must be deposited at a place reserved for this purpose. Then a great festival is celebrated, and the child is given a name. On this occasion the father has to give away a great part of his property. Dawson gives very valuable information on this giving-away of property, which was well known to be practised by the tribes of the north-west coast, but the meaning of which was not clearly understood. He says, —

"The rules governing the *potlatch* (as this festival is called in the Chinook jargon) and its attendant ceremonies have grown to be so complicated that even those persons most familiar with the natives can scarcely follow it in all its details, and it is sometimes difficult for the natives themselves to decide certain points. The custom was formerly almost entirely confined to the recognized chiefs, but of late years it has extended to the people generally, and become very much commoner than before. It is regarded as a means of acquiring and maintaining prestige and power, but it has nowadays spread to all classes of the community, and become the recognized mode of attaining social rank and respect.

"As a particular instance of the custom, let us suppose that a man of one tribe has collected together as his own, or obtained control of, say, five hundred blankets, and wishes to make a *potlatch* to some other tribe. He goes to its village, and makes known his intention of distributing a thousand blankets at a certain date. He begins by lending out his stock of five hundred blankets, giving larger numbers to those who are well off. This loan is reckoned a debt of honor, to be paid, with interest, at the proper time. It is usual to return two blankets for every one borrowed. Thus the stranger obtains the thousand blankets for his *potlatch*, which, with the accompaniment of much bombastic speech-making and excitement, are distributed in exact proportion to the social position of those taking part."

Those who receive presents at such a festival become debtors of the man who gives the feast. These feasts are celebrated at a marriage ceremony or when a man wishes to take a new name.

In connection with the remarks on the *potlatch*, Dawson refers to the actual condition of this people, and emphasizes the fact that the best way to civilize them will be the establishment of industries among them. The report on the legends of the people is of great interest, and so is the vocabulary of about seven hundred words, which is of great importance, as our knowledge of that language is very scanty.

BOOK-REVIEWS.

Great Waterfalls, Cataracts, and Geysers. By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

Chips from the Earth's Crust. By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

THESE two publications present in a readable form certain phenomena of physical geography; the former treating of famous cataracts and geysers, the latter with a variety of geological phenomena such as obtrude themselves upon the attention of the reading public. The book on waterfalls and geysers is well illustrated, and the author has described almost exclusively those cataracts of which he was able to give an illustration. The papers of which the 'Chips from the Earth's Crust' consist were originally contributions to the *Scotsman* newspaper. Eruptions of volcanoes, great land-slides, tornadoes, discoveries of new gold-fields, the fall of a meteor, earthquakes, and similar phenomena, have given occasion to writing these papers; and we think the author has well accomplished his task to write in an agreeable form to such people as have no time and occasion for systematic study, but want to know what has been discovered regarding the history of the earth and the cause and true character of current geological events. The book contains a considerable number of illustrations.

Mineral Resources of the United States. By DAVID T. DAY. Washington, Government. 8°.

THE annual report on the mineral resources of the United States for the year 1886, compiled in the Division of Mining Statistics and Technology of the United States Geological Survey, has just been issued. We find in this volume, which is the fourth of the series, a minute and exhaustive report on the production and economic value of minerals in the United States. The arrangement is according to materials, and under each heading the total production, recently opened mines, technical improvements, imports and exports, are treated. The statistical tables of the preceding volumes have been brought forward to the close of 1886. Besides the report on the annual production, the volume contains a brief and interesting review on the American iron industry, from its beginning in 1619 to 1886, by James M. Swank, and an elaborate paper on the iron ores east of the Mississippi River, by John Birkinbine, to which are added analyses of foreign iron ores smelted in this country. The volume is very exhaustive, not only treating of metals, coal, petroleum, etc., but giving also a review of the production of structural materials, fertilizers, precious stones (the last by George F. Kunz); in short, of all minerals of any economic value.