for this preliminary work: Major Powell, who has probably studied the Rocky Mountain and arid region more carefully than any one else, declares that the scheme is a perfectly feasible one, and that the cost, though very great, will be but a small fraction of the value of the land reclaimed. While the western portion of the United States is not yet crowded when compared with Europe, or even with other parts of our own country, it is no longer true that "Uncle Sam is rich enough to give us all a farm." But, if 150,000 square miles of the arid lands of the United States could be reclaimed, the limits of our agricultural development would be enormously extended.

Re-organization of the United States Fish Commission.

The bill prepared by Professor McDonald, and introduced in the House of Representatives, to re-organize the United States Fish Commission and to define its duties, declares "that it shall be the duty of the commissioner of fish and fisheries to continue the systematic investigation of waters of the United States, and of the biological and physical problems they present, with the object of determining the character, abundance, geographical distribution, and economic value of the inhabitants of the waters, both salt and fresh, as also their migrations, and the cause influencing or regulating the same. This investigation is to be conducted on a broad and comprehensive plan, so as to arrive at the life-history of all species having economic value, as well as those species to which they are intimately and essentially related.

"That he will continue the investigation into the history of the methods and apparatus of the fisheries and for the preservation and utilization of fishery products now in use, and will cause careful study to be made of new methods and apparatus introduced from time to time with the object of determining their effect upon production, and furnishing the information upon which to frame intelligent legislation regulating the conduct of the fisheries and improving their methods and apparatus.

"That it shall be the duty of the commissioner of fish and fisheries to provide for the collection of the statistics of the fisheries of the United States, especial reference being had to the fisheries of the Great Lakes and of the New England and North Pacific coasts of the United States, which are of international importance, and may influence or become the subject of treaty stipulations. The statistical inquiry hereby authorized and directed shall be comprehensively planned to accomplish the purposes for which it is instituted.

"That it shall be the duty of the commissioner of fish and fisheries to continue the work of artificial propagation of food-fishes and other useful inhabitants of the water with a view to their introduction into and establishment in the interior and coast waters, and to the maintenance and improvement of the important commercial fisheries of the coast and interior lakes and rivers. To this end he will, in his annual estimates transmitted to Congress, provide for the maintenance and operation of the existing stations of the commission, and for the maintenance and operation of such additional permanent and field stations as may be from time to time authorized and directed.

"That the commissioner of fish and fisheries shall appoint such employees as Congress may from time to time provide, with salaries corresponding to those of similar officers in other departments of the government, and he shall, as Congress may from time to time provide, employ other persons, of expert knowledge, for such time as their services may be needed, including chemists, naturalists, and physicists, for the conduct of the researches and investigations required in the performance of the duties devolved upon this department, or which may be from time to time authorized and directed by Congress."

HEALTH MATTERS.

CONTAGION IN COURTS. — The State analyst of New Jersey, in a recent trial, when called upon to take an oath as witness, avoided kissing the Bible on the ground that he might contract disease by so doing, saying, "So many different persons have kissed that book, that I do not think it safe to touch my lips to it." The court held that the witness must kiss the book, and he reluctantly did so. This seems like a trifling matter, and yet it might be a serious one. The danger of contracting disease in this way is not imaginary. Until courts so disinfect the Bible on which oaths are taken as to make the act of kissing it safe, we would advise the practising of a device which the writer has for years employed; viz., to kiss the fingers with which he holds the book.

EDUCATING THE WHITE BLOOD-CORPUSCLES. — Dr. Ray Lankester, in an address on 'The Struggle for Life' (*The Hospital Gazette*), in speaking of the function of the blood-corpuscles, said that the corpuscles could be educated to deal with the bacteria, and the future of preventive medicine would be the education of the white blood-corpuscles. The fact that one man, by constant use, could without injury take a dose of arsenic that would kill six ordinary men, was due to the fact that he had by weakened doses been educating and training the white corpuscles. They could be taught to eat and flourish under conditions which, if not commenced gradually, would be destructive to them, and that was the principle underlying protective inoculation. As a preventive of many fatal diseases in sheep and oxen, inoculation had been remarkably successful. The corpuscles first received a weakened breed of disease by inoculation, and thus when a violent attack came they were ready to receive and dispose of it. This education of the corpuscles, it seemed to him, was the explanation of the success of vaccination. They received a weak dose of the poison from the vaccine, and were in that way prepared for a stronger dose in the way of small-pox. He believed the white corpuscles could be trained to receive the most virulent poisons, and he hoped this training would be carried on so as to deal with a great number of diseases.

ELECTRICAL SCIENCE.

Sir William Thomson's Electrical Measuring-Instruments.

FOR some years past Sir William Thomson has been working on electrical measuring-instruments with a view to perfecting some means of accurately and easily measuring the heavy currents and the potentials used in commercial work. Mr. J. A. Fleming, in *Industries*, describes the latest forms Sir William has produced. The ammeters are six in number. The different types are, —

The Centi-ampère balance from	1	to	50	centi-ampères
" Deci-ampère	"	"	1	"	50	deci-ampères
" Ampère	"	"	½	"	25	ampères
" Deka-ampère	"	"	2	"	100	"
" Hekto-ampère	"	"	10	"	500	"
" Kilo-ampère	"	"	50	"	2,500	"

All of these instruments are on the same general plan. The attraction between two coils carrying the current — one movable, the other fixed — is balanced by a weight sliding on a scale-beam. Heretofore the difficulty in such an arrangement has been in getting heavy currents to the movable coil without greatly decreasing the sensitiveness of the apparatus. In these instruments there are two movable coils, fastened on the two ends of a light frame, and below each of them is a fixed coil. The frame has an axle in the middle by which it is suspended, and it is in the suspension that the chief novelty and improvement lie. The axle ends in two semi-cylindrical trunnions. Above them are two similar fixed trunnions. The two sets are connected by a number of extremely fine copper wires bearing on the rounded surfaces of the lower trunnions. This arrangement allows a free though limited movement of the frame, and the numerous fine wires will carry a heavy current. The winding of the two coils are such that one end of the frame is repelled, the other attracted, when a current passes. There is a scale-beam attached to the frame, and a weight moving on this is shifted until the frame is horizontal. The reading on the beam opposite the weight gives the current that is flowing. The great advantage of this arrangement, as in other forms of electro-dynamometer, lies in the fact that the readings are independent of any change in the strength of magnets, such as are used in ordinary commercial measuring-instruments, and also of the value of the earth's magnetism. The instruments, however, are not so portable as many other forms, and are somewhat difficult to adjust. They will be useful for standardizing the ordinary forms of voltmeter and ammeter.

ELONGATION AND CONTRACTION OF METALS IN MAGNETIC FIELDS. — The first experiments made by Joule on the effect of magnetization on the length of iron showed that the iron always elongated. Mr. Bidwell has investigated the effects of very much more intense magnetic forces than were used by Joule. At first the iron expanded, but, after reaching a magnetic force of about 90 C.G.S. units, the iron began to contract, reaching its original length at about 280 C.G.S. units, and contracting continuously until the force reached 800 C.G.S. units, the limit of the experiment. Cobalt, nickel, manganese, steel, and bismuth were also experimented on. The two latter were practically uninfluenced in length by the application of any magnetic force. Nickel and cobalt began to contract from the first: nickel continued to contract to the limit of the experiment; cobalt contracted until the value of the force was about 400 C.G.S. units, when it expanded again; not, however, reaching its original value at a force of 800 C.G.S. units.

A NEW ALTERNATING-CURRENT ELECTRO-MOTOR. — Patents have recently been issued to Nickola Tesla for an alternating-current transformer and a motor which embody some novel features. The motor is especially interesting: it is really a modification of a plan proposed by Prof. Elihu Thomson, although the arrangement is different. The armature consists of two coils wound at right angles to each other on an iron core. The coils are short-circuited on themselves, and are not in any way connected with the external circuit of the dynamo supplying the current. The field-magnet consists of an iron ring, the four quadrants being wound with coils, of which the two opposite are connected. The dynamo used to supply the currents has two sets of coils, giving alternating currents of exactly opposite phases. These currents are taken to the motor by separate circuits, and are connected to alternate quadrants of the field-magnet. The action of the motor consists in inducing, by the alternating currents in the field, currents in the closed circuit armature coils, and in alternately attracting and repelling the coils. This motor, then, has no commutator nor brushes, and, if it works, will be the simplest possible means of transforming energy. As to the efficiency and output of this motor, we will have more to say later.

HEATING EFFECT OF ELECTRIC CURRENTS. — M. Cailletet has experimented on the heating of wires by an electric current when the pressure of the air around the wire is increased. He finds that the heating effect is decreased as the pressure increases. A current that would fuse a wire under ordinary pressures, will only raise it to a dull redness when the pressure is increased. This shows the importance of convection in incandescent lamps, and the desirability of the highest attainable vacuum.

VARIATION OF CO-EFFICIENTS OF INDUCTION. — Mr. W. E. Sumpner has experimented on the co-efficients of self-induction of transformers under various conditions. He finds that the co-efficient varies greatly with different conditions of current, etc., and plots curves representing the values for different currents, defining the co-efficient as the rate at which magnetism changes with the current. The results of Mr. Sumpner's work show, perhaps, for the first time, the very great variation in a co-efficient that has been taken as constant in a large number of solutions of problems bearing on the subject of alternating currents. In this connection a series of papers on induction-coils, that is now being published in the *Electrical World*, is important. Heretofore the subject of alternating currents has not been experimented upon in a way to show whether the assumptions that have been made are approximately correct. These 'Experiments on Induction-Coils' show that many of the solutions that have been given are altogether wrong. So far, however, the most important papers of the series have not been published: their appearance is awaited with interest.

NEW METHOD OF READING REFLECTING-INSTRUMENTS. — The following is an abstract from a paper by M. F. Drouin, in the *Lumière Electrique*: "The usual mirror is replaced by a thin disk of glass. The scale being behind the instrument, the observer in front sees the scale directly through the glass; while he sees reflected from the front surface of the glass the image of an object, such as a black line on a white background, placed in front of the instrument and to one side. When the glass disk is deflected through an angle α, the virtual image of the mark is displaced through a distance d. tan 2α (d=distance from glass to scale). The method can be used in a well-lighted room, and does away with all the trouble of lamps and shades."

BOOK-REVIEWS.

Tenth Annual Report of the Connecticut State Board of Health for the Year ending Nov. 1, 1887, with the Registration Report for 1886. New Haven, State.

IN addition to the usual official reports and tables of vital statistics, this volume contains a report on river-pollution by Prof. S. W. Williston, M.D., Ph.D., with reports on water-analyses by Prof. H. E. Smith, M.D., and William G. Daggett, M.D. This report is a very valuable and thorough one, and covers nearly one hundred pages. It is the outcome of an act of the Legislature authorizing the State board to investigate and ascertain, as far as practicable, all facts in relation to the pollution of streams and natural waters of the State by artificial causes, in order to determine the sanitary and economic effects of such pollution. In the report are described the chemical processes employed in the manufacture of brass, iron, paper, woollen, cotton, and silk goods, hats, and rubber goods, and the impurities which are cast into the streams of the State from these manufactories. In the analyses of the water, both the biological and chemical methods were employed.

The annual report also contains reports on an epidemic of dysentery in Thomaston, by R. S. Goodwin, M.D. In this report the author presents the following conclusions as a result of his study of the epidemic: "that the outbreak of dysentery at Thomaston, and at every other town on the Naugatuck River, occurred in consequence of the co-operation of several favorable influences. These were a certain season, a certain high temperature, a certain favorable location, unsanitary modes of living, and the use of impure drinking-water. Nevertheless, infection with a certain specific poison was the sole cause of this disease, and the *rôle* played by these influences in its etiology was only to increase the predisposition to the affection by rendering the human organism more sensitive to the action of this unknown poison."

Dr. C. W. S. Frost contributes a sanitary report of the city of Waterbury, from which it appears that small-pox, diphtheria, measles, and dysentery prevailed during the year.

Dr. F. E. Beckwith has contributed remarks on the recent outbreak of typhoid or enteric fever at Southampton, L.I. Just why this report is printed in the 'Annual Report of the Connecticut State Board of Health,' does not appear, unless the explanation is to be found in the following paragraph: "The sanitary suggestions which close the paper apply not only to Southampton, but to every small seaside resort in a developing state, where there are similar conditions of soil, surface of country, and water-supply." The remarks are instructive and to the point, and are worthy a place in the report.

Eleventh Annual Report of the Board of Health of the State of New Jersey, and Report of the Bureau of Vital Statistics, 1887. Trenton, State.

IN this report are the following papers: 'The Legal Aspect of the Pollution of Streams,' by E. S. Atwater; 'Air, Water, and Food,' by Ezra M. Hunt, M.D.; 'Outlines of Representative Sewer Systems,' by J. J. Croes, C.E., F. S. Odell, C.E., George P. Olcott, C.E., C. P. Bassett, C.E., and Charles McMillan, C.E.; 'Exposure and Diseases of Operatives,' by D. Warman, M.D.; 'Typhoid-Fever at Mount Holly,' by E. M. Hunt, M.D.; abstracts from papers and discussions of the New Jersey Sanitary Association; 'Report on the Water-Supply from the Passaic Watershed,' by Prof. A. R. Leeds, Ph.D.; and reports from the health-inspectors. The board's report also contains a list of persons practising medicine in the State.

In his paper on air, water, and food, Dr. Hunt discusses the influence of impure air on the death-rate, and refers to the investigations of this subject by Messrs. Carnelly and Haldane of University College, Dundee; and also those of Dr. Anderson, the health-officer of that city. Several experiments showed that the average of carbonic acid and organic matter was uniformly higher in town than in suburban or country air, and that in open places the carbonic acid