added would establish a compound which could be fired successfully in a specially constructed shell.

"(4) The gelatine does not require a fuze or detonator of any kind.

"(5) It is believed the shell which destroyed the 3.2-inch breech-loading gun broke from the shock of discharge, or admission of powder-gas, and thus detonated the gelatine."

In the summer of 1884 the Ordnance Board fired four cast-iron screw shells from an 8-inch muzzle-loading rifle, using forty pounds of powder in the gun, and from five to eight pounds of gelatine in the shells, at each discharge. The gun was mounted on a cradle, and directed at a target 383 feet distant. One of the shells burst at or near the muzzle with little comparative violence. The other three reached the target, penetrated about seven inches, and detonated from the shock. These trials led to the making of six steel shells, three of them being cast, and three forged. Analysis of the facts connected with these experiments shows —

"(1) That the 3-inch shells designed for gunpowder charge, when loaded with Hill's explosive gelatine, three months old, all cleared the gun without injuring it in the slightest.

"(2) That the shells, having to be charged through the fuze-holes with the dynamite, were necessarily packed loosely, thus subjecting the charge to the powerful action of angular velocity.

"(3) That in the trials made with the 3.2-inch gun, two Butler shells, charged with black gunpowder, broke up 'at or near the muzzle;' while of the two Butler shells charged with Nobel's gelatine, or dynamite, one broke up 'at or near the muzzle,' and the other reached the target and exploded on impact.

"(4) That in the trials made with the same 3.2-inch gun, using thin Hotchkiss shrapnel cases, charged with Nobel's dynamite or gelatine, all cleared the gun in safety (one reaching the target after passing through two-inch boards) with the exception of one, which the board reported on as follows: 'It either broke from the shock of discharge or admitted powder-gas.'

"(5) That *all* the trials with the 8-inch shells charged with *fresh* Nobel's dynamite or gelatine were successful, three of the shells detonating at the target, and one only exploding at or near the muzzle; that the gelatine used when the premature explosion took place was sixteen months on hand in this country after crossing the ocean, and therefore not such as was recommended by General Abbot, or contemplated by the board."

Major McKee's conclusions are as follows: that the United States officers undertaking the investigation of this subject were necessarily compelled to institute their inquiries *de novo*. All foreign information was so meagre, so unsatisfactory, and so shrouded in mystery, in accordance, doubtless, with the policy of the European governments, that it was seen, after careful investigation, that all trustworthy knowledge would have to be gleaned by Americans through experience. In obtaining this experience, devices have been experimented with, invented by Mr. Snyder, who presented several plans; Mr. C. P. Winslow, with a nitro-glycerine shell, in which the glycerine and combined nitric and sulphuric acids are placed in separate glass vessels within the shells; Mr. Garrick, with a mortar and projectile for nitro-glycerine; Mr. D. P. Hill, with an 8-inch explosive gelatine shell; Mr. Stevens, with a double shell for high explosives; Mr. Graydon, with a shell containing the dynamite in capsules; Mr. Taylor, who brought his own gun, and attempted to use dynamite as a propulsive charge; and Mr. Smolianoff, experiments with whose gun were made as late as last October.

In all these trials, Major McKee said, as to the practicability of using dynamite as a shell-explosive, that it was well understood by the officers undertaking them that the crude blasting compound of industry, which was the only available explosive attainable, was not the eventual product of chemistry which would satisfactorily answer this purpose. It was known that great improvements had been made in the dynamites of all kinds, especially in blasting dynamite, or gelatine of Nobel, and that these compounds presented in transportation by all modern conveyances, and in all mining and other industrial works, as much, if not greater, safety than the black war, sporting, and blasting gunpowders of commerce. With this status of dynamite apparent, it was seen that the time had arrived for military men in the United States to begin experiments with it as a shell-explosive, with some possibility of success. When it was demonstrated that the freshly prepared crude commercial dynamite might be fired in a shell from an 8-inch gun with a charge of forty pounds of black gunpowder, the only question that then remained was as to the stability and reliability of the compound through age. And when, after sixteen months' storage, it appeared to be more sensitive to shock, the Ordnance Board recommended that no more experiments be made with it until it was further camphorated, or otherwise treated by competent chemists. And it was ascertained further, in these few and inexpensive tests, that the heat developed by the angular velocity was a more potent factor in detonating the dynamite than was the shock of discharge. It has been seen, also, that, since the comparatively recent discovery of nitro-glycerine, its development has been rapid in the protean forms of dynamite. In Europe experiments are being constantly conducted to perfect this agent, and doubtless they will succeed. Even now they claim in France and Germany to have perfected melinite and helphonite, — compounds probably of nitro-glycerine and some of the ethers. In Russia they also announce some new improvements that are not known here. But in the near future there is every probability that the problem will be solved in this country.

ELECTRICAL SCIENCE.

Electrical Testing-Laboratories in Paris and Vienna.

THE Société Internationale des Electriciens has completed and opened a laboratory whose main purpose will, for the present, be the testing and calibrating of electrical apparatus. M. de Nevville will be the director. The following measurements will be made: resistance, capacity, electro-motive force, constants of batteries, of cables and wires, insulation resistance, efficiency of dynamos (provisionally of continuous-current machines), and co-efficients of induction. When the means allow, purely scientific researches will be carried on. The laboratory is built on a modest scale, and seems to lack a few pieces of apparatus that will probably be supplied: for example, there is no provision for measuring mechanical work, — a measurement necessary in many cases for the tests of dynamos and motors.

The laboratory in Vienna is an addition to the Technological Museum in that city. Herr Carl Schlenk will superintend the work, which will include very much the same kind of tests as are to be made in the Paris laboratory.

The establishment of these two laboratories is important. The applications of electricity have rapidly advanced, and have assumed a permanent character. The questions in many cases are not, 'Can electricity do this?' but, 'How cheaply can it be done?' and this last question can only be answered by measurements. As competition increases, and as that part of the public looking for investment becomes less satisfied with the mere running of a machine, and demands accurate measurement of its performance, the necessity of some reliable means of comparing measuring-instruments becomes necessary. In England the Central Institution of London has undertaken the work; in Austria, the Technological Museum at Vienna; in France, the International Society of Electricians. Our country has outstripped all others in the applications of electricity. Probably we will soon have some means of comparing electrical apparatus, and testing the value of the numerous appliances daily patented. Electrical progress has been retarded and discredited by worthless patents in which a great deal of money has been invested and lost, while a simple test, taking little time and made at little expense, would have shown them valueless.

DUJARDIN'S METHOD OF FORMING SECONDARY-BATTERY PLATES. — Several methods have been tried, and some are now commercially used, of obtaining a quick formation of 'active material' — peroxide of lead and spongy lead — for secondary-battery plates. The Planté process of reversing the current is employed by some makers, while others deposit the peroxide and lead on support plates from an alkaline solution of litharge, as in the Moutard batteries. Dujardin's process of obtaining a deposit is as follows: the lead plates are put into a solution of sulphuric acid and sodium nitrate in water (10 of water, 2 of sulphuric acid, 1 of sodium or potassium nitrate), and a current is sent through the cell. By the passage of the current, nitrate of lead is formed, the lead

being dissolved from the positive plate; and this is changed into sulphate of lead, and afterwards by the current into peroxide of lead. In a few hours the plate is covered with a layer of crystalline peroxide of lead. During the formation, air is forced through the cell, or the plates are lifted from the liquid at intervals. In the absence of data as to the performance of plates formed in this way, it is impossible to compare them with the ordinary 'grid' plates, pasted with red lead by the Faure process. The disadvantages of this last form have been pointed out in a previous number. The type of cell under which that of M. Dujardin comes — the 'Planté' form — generally offers the advantage of quicker discharge rate, and freedom from 'buckling,' as against the greater storage-capacity of the Faure type. How far M. Dujardin has remedied the difficulties of the type outside of the time necessary for formation, remains to be seen.

DISCUSSION OF ALTERNATING-CURRENT TRANSFORMERS. — The papers of Messrs. Kapp and Mackenzie before the English Society of Telegraph Engineers and Electricians have excited a great deal of interest and discussion on the subject of alternating currents. A number of people, many of them directly interested in electric lighting, have spoken on the matter. The majority of the speakers seemed in favor of the system, although it was attacked by Messrs. Gordon and Crompton, who prefer using storage-batteries for distribution. Arguments in favor of the alternating-current system were drawn from the experience of the Westinghouse Company in the States, that would be more weighty on this side of the ocean, if they were known to have been carefully verified. Some results of tests of the efficiency of transformers were given by Professor Ayrton, — the method of testing having been borrowed from our side of the water, — and values of 96 per cent were obtained under the most favorable conditions. As has been pointed out, however, in a former number of this journal, the transformers only work at the maximum efficiency for a short time during the day, so that the average efficiency will not probably be above 80 per cent. Various speakers favored different systems of distribution, but there were very few who had no experience to give; and the discussion was an interesting and instructive one.

BOOK-REVIEWS.

Transactions of the Association of American Physicians. Second session, held at Washington, D.C., June 2 and 3, 1887. Philadelphia, Assoc. Amer. Phys.

THE Transactions of the Association of American Physicians at their second annual meeting in Washington has been published. This association is without doubt the most representative body of the medical profession of the United States, having on its roll of membership the most prominent physicians of the country. The papers which are contained in this volume are of a very high order, and the discussions are exceedingly pointed and valuable.

The treatment of consumption by Bergeon's method, that is, by gaseous enemata, was the subject of three of the seventeen papers, the authors being Edward T. Bruen, M.D.; F. C. Shattuck, M.D., and Henry Jackson, M.D.; and William Pepper, M.D., LL.D., and J. P. C. Griffith, M.D.

Dr. Bruen sums up his views in these words: "I incline to think that suitable climatic environment is an all-important adjunct to the proper settlement of the value of Bergeon's treatment. But it is certainly an important addition to our therapeutic equipment to have an agent capable of influencing very markedly bronchial catarrh in so many cases, especially the 'stay-at-homes.' In a word, Bergeon's method, so far as I have used it, is chiefly valuable in those cases of pulmonary disease attended with bronchial catarrh. But I fear the trouble and detail necessary to its successful use will prevent many from employing the method, and I can easily see that the limitation of the power of Bergeon's method will cause it often to be set aside for other plans of treatment."

Drs. Shattuck and Jackson say, "This method is in no sense a specific for phthisis. If useful, it is only as auxiliary to older and generally accepted methods. The only benefit which we saw in our cases that can fairly be attributed to the enemata was diminution in the amount of the expectoration. The good effects which have unquestionably followed the treatment on this side of the water, as well as in France, are perhaps largely attributable to the stimulus afforded by a novel method of treatment, which is of such a nature that the patient cannot but feel that not only something, but much, is being done for him."

Drs. Pepper and Griffith conclude as follows: "Our conclusions, so far as they can be formulated in a preliminary report of comparatively few cases, are, that the treatment of phthisis by gaseous enemata has had very undue value attributed to it; that it is seldom of any real benefit, but that it may prove serviceable in occasional cases."

Dr. Henry Hun presented a paper on sewer-gas poisoning, with a history of twenty-nine cases. He concludes that it is probable that the following conditions may result from poisoning by sewer-gas: 1. Vomiting and purging, either separately or combined; 2. A form of nephritis; 3. General debility, in some cases of which the heart is especially involved; 4. Fever, which is frequently accompanied by chills; 5. Sore throat, which is frequently of a diphtheritic character; 6. Neuralgia; 7. Perhaps also myelitis of the anterior horns; 8. Zymotic diseases, such as typhoid-fever, pneumonia, diphtheria, cholera, dysentery, cerebro-spinal meningitis, erysipelas, and scarlet-fever (in these cases, undoubtedly, the sewer-gas merely acts as a vehicle for the specific germs); 9. A condition of asphyxia, which in its severe form is characterized by coma, convulsions, and collapse; 10. Puerperal fever; 11. Abscesses; 12. Lymphadenitis; 13. Acute aural catarrh (?).

The only other paper read at the meeting, which was of general interest, was one on methods of research in medical literature, by John S. Billings, M.D., U.S.A. This paper contains a good deal of excellent advice to physicians who desire to read up on any particular subject for the preparation of articles for publication or presentation to medical societies. Dr. Billings thinks that one of the most useful pieces of work which could now be undertaken for the benefit of medical writers and investigators would be the preparation of a dictionary of critical bibliography of medical bibliography, in which should be indicated for each subject, in alphabetical order, a reference to where the best bibliography relating to that subject can be found. This could only be well done by a co-operation of a number of writers, each taking a special field. This useful paper of Dr. Billings closes with a list of forty of the most useful reference-books, commencing with Albertus Haller's 'Bibliotheca Botanica' (1751), and ending with Richard Neale's 'First Appendix to the Medical Digest' (1886).

The other papers which were presented to the association were purely medical, and of little general interest.

Sewage Treatment, Purification and Utilization. A Practical Manual for the Use of Corporations, Local Boards, Medical Officers of Health, Inspectors of Nuisances, Chemists, Manufacturers, Riparian Owners, Engineers, and Rate-Payers. By J. W. SLATER, F.E.S. New York, Van Nostrand. 8°.

THIS octavo of 271 pages is one of the Specialists' Series, of which a number of treatises have already been issued, and of which several more are now in preparation. The title of the book before us is, we think, a little misleading. The reader expects from such a comprehensive title a good deal more than he actually finds when he reads the book. Still, the subjects which the author treats are handled in a very interesting and decidedly original manner, and, when the book has been read through, the reader is surprised that so much has been put into so small a space. Its perusal impresses one with the idea that Mr. Slater is a practical man, and that he writes of that which he knows from personal experience and observation, and not from a closet study of the books of others.

In his preface he refers to the unsettled state of the sewage question. Freezing and heating, concentration and dilution, electrization and magnetizing, the addition of oxidizers and deoxidizers, of ferments and preventives of fermentation recommended, if not actually tried, show the want of any distinct and generally recognized principle. This is still more forcibly illustrated by the fact that since 1846 there have been no less than 454 patents issued for the chemical treatment of sewage. In the space at our disposal it will be impossible to follow the author in detail; but there are some points