in all its force and peculiarities. Over and over again this little experiment was performed without variation in its results, until, finally, satisfied, I moved my head off my arm and stretched my arm out of its cramped position, and felt no more this *bête noir* of earlier days, now again returned, bringing with it emphatic and unmistakable explanation of its cause.

G. V. D.

ASTRONOMICAL NOTES.

A NEW SATELLITE OF SATURN.

A NEW satellite of the planet Saturn has been discovered by Professor William H. Pickering at the Harvard College Observatory. This satellite is three and a half times as distant from Saturn as Iapetus, the outermost satellite hitherto known. The period is about seventeen months, and the magnitude fifteen and a half. The satellite appears upon four plates taken at the Arequipa Station with the Bruce Photographic Telescope. The last discovery among the satellites of Saturn was made half a century ago, in September, 1848, by Professor George P. Bond, at that time Director of the Harvard College Observatory.

EDWARD C. PICKERING.
HARVARD COLLEGE OBSERVATORY,
CAMBRIDGE, MASS., March 17, 1899.

NOTES ON PHYSICS.

THE NERNST LAMP.

THE electric lamp recently invented by Nernst, as has been stated in this JOURNAL, consists of a small rod of magnesia which is heated to brilliant incandescence by an electric current which is pushed through it by an electromotive force of several hundreds of volts. The rod must be heated nearly to a red heat by a blowpipe or other independent means before it passes sufficient current to operate.

A number of these lamps have been made in the Physical Laboratory at Bethlehem, Pa. It has been found that a rod of pure magnesia can scarcely be started even with 1,000 volts and a good blow pipe. The surrounding air becomes electrically too weak to withstand the high electromotive force at a temperature lower than that required to make the rod a sufficiently good conductor. This is true even when the rod has been heated to softness beforehand in a temporary mounting.

The conductivity of the rod may be completely controlled by mixing with the magnesia varying amounts of silica and of fusible silicates. A satisfactory lamp is made as follows: Pure calcined magnesia (heavy) is thoroughly mixed with two or three per cent. of powdered silica, one or two per cent. of magnesium sulphate, and one per cent. or less of sodium or potassium silicate (water glass). The mixture is dried until it is just moist enough to pack under pressure. A small piece of brass tubing is lined with a roll of several thicknesses of stiff writing paper, and the mixture is tamped into this tube. The tube is then baked until the paper is burned, when the rod of magnesia may be removed. This rod is then laid upon a bed of magnesia (powdered lime would, perhaps, answer) and by means of carbon terminals an alternating current is passed through the rod, heating it first to redness by a blow pipe. With some care a very hard and compact rod of magnesia is thus formed which is then ground to a thin rod with large grooved ends. Platinum wire is wound on these grooved ends and, if desired, cement made of water glass and powdered magnesia may be used to cover the platinum. The two platinum wire terminals may then be bound to the sides of a small glass tube as a support. A lamp made in this way may be started easily, although its resistance rises slowly with continued use, owing, perhaps, to the volatilization of the potassium or sodium silicate. Calcium silicate would, perhaps, be more satisfactory in this respect.

A very striking experiment may be performed with a piece of glass tubing several inches long wound with copper terminals at its ends. The tube begins to pass considerable current at a low red heat, with a few hundreds of volts, and is quickly melted by the current. A thin-walled tube half an inch or more in diameter is best, and it should be heated along one side only so that the cool portion of the tube may for a short time serve as a support for the hot conductive portion.

W. S. F.

PYROELECTRICITY AND PIEZOELECTRICITY.

W. VOIGT (*Wiedemann's Annalen*, No. 13, 1898) shows that the electrification of certain crystals by heating (pyroelectricity) and the electrification by deformation (piëzoelectricity) are in general one and the same phenomenon, and that it is only in such a crystal as tourmalin, which has a single axis distinguished from all other axes by characteristic physical properties, that pyroelectricity is not due wholly to the deformation accompanying a rise of temperature. Professor Voigt also points out that a plate of tourmalin can be used to generate accurately known electric charges by subjecting it to measured compression, and he gives the results of a determination of an electrostatic capacity based upon the known charge generated by a tourmalin plate and the known e. m. f. of a standard cell. W. S. F.

THE ROTARY CONVERTER.

IN two short articles in the *Electrical World*, for December 17th and 24th, Mr. C. P. Steinmetz gives a quite complete discussion of the theory and action of the rotary converter, a machine used to convert alternating current into direct current, mainly in connection with long distance transmission. Mr. Steinmetz's papers are, almost without exception, very difficult to read for the reason, chiefly, that he always gives a great deal of precise information about difficult subjects not generally understood. The present paper cannot, of course, be abstracted, but it is mentioned for the reason that Mr. Steinmetz deserves to be more generally known as one of the foremost electricians of our time; that he is a scientific electrician is a matter of course. W. S. F.

THE TELESCOPE-MIRROR-SCALE METHOD.*

PROFESSOR S. W. HOLMAN has given in the *Technology Quarterly*, for September, 1898, a most complete and usable discussion of the telescope-mirror-scale method for measuring angular deflections. Almost at the very beginning of the paper a list of the fourteen instrumental errors is given, together with directions for making the adjustments which are necessary to reduce each error to a prescribed value. Following this is a general discussion of each error of adjustment and a derivation of the error in angle due to each. Most physicists have, of course, looked into the detailed theory of the telescope-mirror-scale method in spite of the fact that the literature on the subject is not generally accessible, but the habitual use of the method for rough measurements makes one lose sight of a dozen or more of the adjustments and precautions which are necessary in accurate work, and, therefore, almost every physicist will find this pamphlet of Professor Holman's a useful reminder when the need arises to use the method with all the precision it is capable of. W. S. F.

*Published separately by John Wiley & Sons, New York. Price, 75 cents.

NOTES ON INORGANIC CHEMISTRY.

SOME time ago a committee was appointed by the German Chemical Society to formulate an atomic-weight table which should serve as a basis for practical use in analytical calculations. This committee consisted of Professors Landolt, Ostwald and Seubert, and has recently brought in a report which has been widely published. With three exceptions, the decimals in the atomic weights are given only as far as the last figure is practically correct. The weights as far as given agree in general with those published by Professer F. W. Clarke. The most interesting point in connection with the table is that the basis used is the atomic weight of oxygen = 16. It is now a number of years since Dr. F. P. Venable and others in this country and abroad uttered strong protests against the use of hydrogen = 1 as a standard, especially since the atomic weights with few exceptions are determined with reference to oxygen, and at that time the ratio between hydrogen and oxygen was uncertain. Now that this ratio has been, thanks to Professor Morley, rendered almost certain to three decimal places, it is still unnecessary and unscientific to bring in even this little uncertainty, which in the elements of high atomic weight amounts to quite an appreciable quantity. Professor Seubert has been one of the strongest advocates of the basis H = 1, and it is noteworthy that he has agreed to the committee report. In the report Seubert says that, while H = 1 is in