SIR NORMAN LOCKYER ON SUN SPOTS.

It is at once inspiring and overwhelming to converse with Sir Norman Lockyer upon his work in the domain of solar physics—overwhelming, because of the immensity of the subject; inspiring, because of the absolute certainty and entire confidence with which he explains his operations and points to the direction by which results may be hoped for. It will be remembered that Sir Norman has expressed the hope that in a few years' time meteorologists will be able as the result of observation of solar phenomena, to predict the time, and even, perhaps, the place, in India in which famine may be expected, and so enable the authorities to take precautions against loss of life, while they will also be able to give warning of high and low floods in Egypt. The vast importance of such a work as this is too obvious to need emphasis. Apart from the humane consideration as to health and happiness, its commercial significance would be enormous in ways which are apparent.

The amount of labor involved in completing the task to which he has set his hand is enormous and difficult beyond comprehension, but Sir Norman and his staff are working methodically along at the Solar Physics Observatory, at South Kensington, and have so far pieced up the threads of the solar skein as to justify a promise as to the ultimate success of the work. Sun spots and "prominences" are the mute prophets of ill-tidings from which the secrets are to be wrung. For more than a quarter of a century his attention has been devoted to the subject, and examination of all the data obtainable bearing upon droughts has given him a possible clue to the causes whose devastating effects we too frequently see in hunger-stricken India. Between the condition of sun spots and prominences, and plenitude of rain or its lack, a distinct connection is more than suggested. The subject is too technical and abstruse for effective treatment in the present article, but it may briefly be said that upon the variations of the spots and prominences, the meteorological condition of India and Egypt depends.

"I have shown," said Sir Norman, "that the famines which have devastated India during the last thirty or forty years have followed a definite law, and, of course, one therefore assumes that a similar thing may happen in the next thirty or forty years; having that law, we ought to be able, in some cases at all events, to observe that certain times are more apt to be associated with famines than other times."

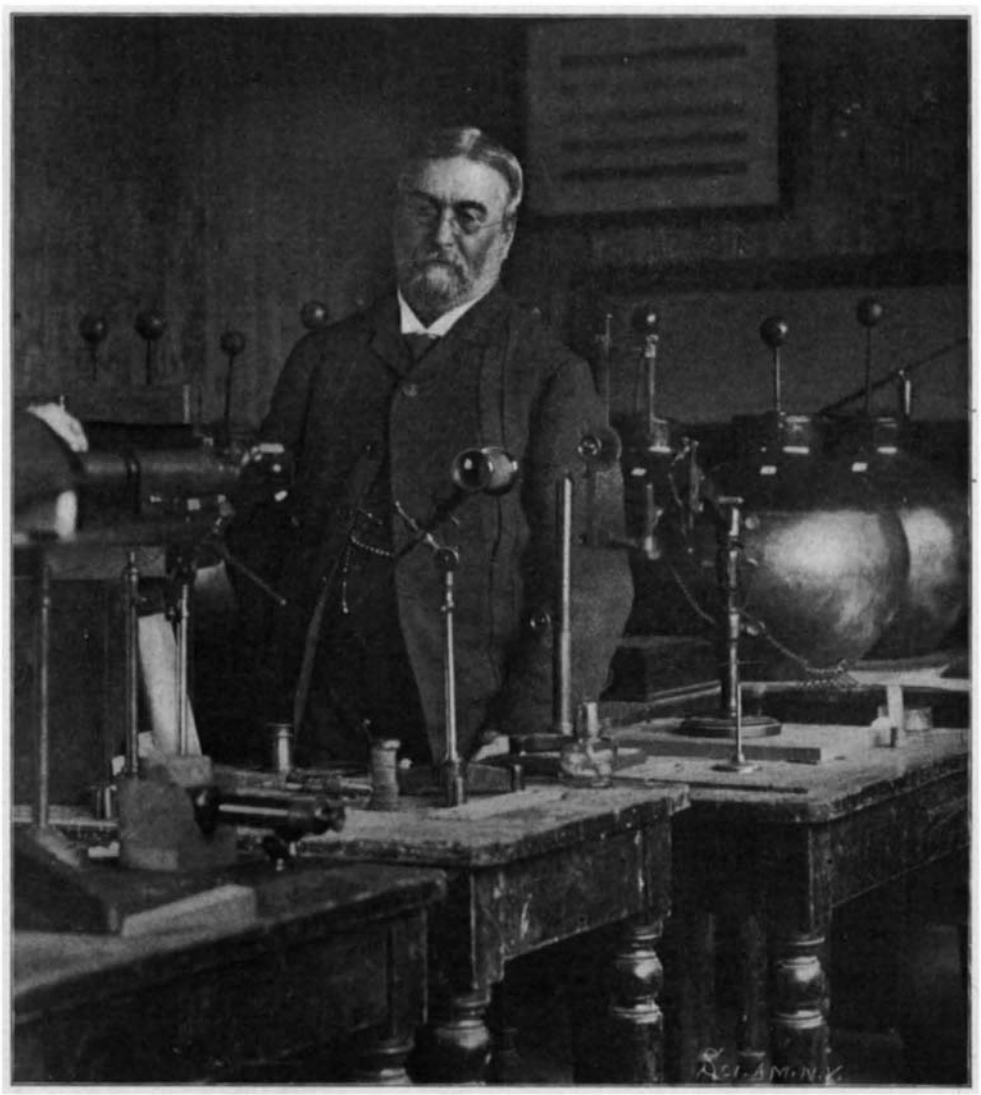
It has been argued that, inasmuch as the sun spots occupy, as to some of them, only an infinitesimal space on the surface of the sun, they are too minute to affect the meteorological results with which they are associated. But Sir Norman points out that the greater disturbance of certain zones of solar latitude is more influential than the amount of spotted area determined from spots in various latitudes. "Sun spots," he said, "may be only millionths of the area, but these prominences form one-sixth of the sun's visible hemisphere, and with these in a state of disturbance, the effects upon the earth are very important. The sun spots themselves are only a very feeble indication of the fierce activity of the sun.

"We are observing those prominences more carefully," he went on, "than we have been able to do in the past. We are taking advantage of new methods of observation, and in a few years we shall be in a much better position than we are now to study the connection of solar and terrestrial meteorology."

At present Sir Norman is concentrating his energies upon India. Asked if he had expectations of his discoveries being applied to other parts of the world, he answered: "No doubt, in the long run, we shall be able to study the weather in other regions, but it is hard enough work to get it out for one place at present."

Sir Norman fears that no profitable discoveries will eventuate from the recent eclipse. Pressure of work at South Kensington, coupled with a fore-knowledge that the break-up of the monsoon would militate against good results being obtained, prevented his absenting himself from his observatory during the four months which the expedition would have involved. The ill-luck with which the expeditions for the most part met he had feared would be encountered.

The sun spot observed lately he regards as of the greatest importance. "It shows us, beyond all question, I think," he informed the writer, "that the minimum is past. And that is a very important matter. It is very remarkable that a spot in the minimum period, apparently the first spot of a new cycle, should be of such magnitude. We are working at it, but cannot say anything definite for the moment. It will take some time before any certain pronouncement can be made, but it looks very much as if it will enable us to fix the period of the minimum, which before was uncertain to a year. If we can fix that, it will be very helpful for subsequent work."—For the photograph from which our engraving was made and the foregoing particulars we are indebted to our English contemporary, Black and White.



SIR NORMAN LOCKYER IN HIS LABORATORY AT SOUTH KENSINGTON.

Metal Niobium.

M. Henri Moissan has lately succeeded in preparing the metal niobium in a pure state by the aid of the electric furnace. Heretofore the properties of this metal have been practically unknown, and the metal itself has not been prepared in the pure state except by Roscoe, who obtained it as a gray powder. M. Moissan now produces a considerable quantity of the metal in the electric furnace, starting from an American niobite which contains niobic and tantalic acids. An alloy of niobium and tantalum is first obtained by reducing the powdered mineral with carbon in the electric furnace. This alloy is crystalline, of a light-gray color, and contains about 2 per cent of combined carbon. By a series of reactions the niobium is separated from the alloy in the form of niobic acid, which, after calcination, is a pure white powder. To prepare the niobium, the acid is mixed with powdered carbon and pressed into small cylinders; a number of these are placed in a carbon trough contained in a carbon tube, and the whole placed in the middle of the electric furnace. A few minutes' heating suffices, with a current of 600 amperes and 50 volts. The decomposition is violent, and as soon as the niobic acid becomes fused a lively effervescence takes place. After cooling, a well-formed ingot of metallic niobium is obtained, which contains from 2 to 3 per cent of combined carbon. The metal has been examined as to its physical and chemical properties. It is quite hard, and scratches glass and quartz easily. It is not fused in the oxy-hydrogen flame, and therefore its fusing-point is above 1,800 deg. C., but in the electric furnace it liquefies easily. As to its chemical properties, it is found to vary considerably from most of the other metals. It does not decompose water vapor at a red heat, and is almost unattacked by acids. Hydrochloric and nitric acids and aqua regia have no action upon it; hydrofluoric and sulphuric acids attack it but slightly, but it dissolves rapidly in a mixture of hydrofluoric and nitric acids. The gases attack it more readily. Heated in fluorine, it becomes incandescent and gives abundant fumes of a volatile fluoride. Chlorine attacks it at 205 deg. C., with disengagement of heat, producing a volatile chloride, $NbCl_5$ of a golden-yellow color. Bromine vapor forms a light-yellow sublimate, but iodine seems to be without action. The niobium, reduced to powder and heated in a current of oxygen, takes fire at 400 deg. with brilliant incandescence, forming niobic acid. When the powdered metal is heated in a current of nitrogen to 1,200 deg., each particle becomes covered with a fine yellow coating of nitride of niobium. The action of carbon is somewhat curious. When the metal is maintained in fusion in the presence of graphite, it slowly absorbs carbon, which enters into combination. Niobium does not readily form alloys with the other metals. Sodium, potassium and magnesium may be distilled over it without combining, and it does not form an alloy with zinc. When heated with soft iron in fusion a small quantity enters into combination with the iron. The alloy shows an irregular structure containing fragments of niobium, a combination of the two metals, or perhaps a double carbide, and pure iron in excess. Oxide of chromium is reduced by the metal in the electric furnace, and gives a brittle alloy of chromium and niobium. Fused potash attacks the metal with the formation of an alkaline niobate. Chlorate of potash reacts upon it at a high temperature with brilliant incandescence, and nitrate of potash attacks it with violent disengagement of nitrous fumes. The reactions obtained with niobium seem to place it apart from the other metals and ally it to boron and silicon.

American Tin Plate Industry.

American manufacturers of tin plate are making rapid gains in their attempt to enter the foreign markets of the world. To be sure, their exports are yet small as compared with the domestic demand which they are meeting, but they are again reducing the imports, which temporarily increased in 1900 under the excessive demand and extremely high price of materials, and are at the same time increasing their exports in a manner which proves interesting to those who have watched the development of this comparatively new industry in the United States. The figures of the Treasury Bureau of Statistics show that the exports of tin plates from the United States, which in the ten months ending April, 1899, amounted to only 183,955 pounds, and in the ten months ending with April, 1900, to 275,990 pounds, were, in the ten months ending with April, 1901, 1,306,100 pounds. In imports of tin plates the figures for the ten months show a material decrease as compared with the quantity imported during the same period of the preceding fiscal year, being 98,609,722 pounds, as compared with 123,598,773 pounds for the ten months' period of last year.

Our total exportations of tin plate in the fiscal year 1901 seem likely to be from eight to ten times those of 1899, while the importations of tin plate into the United States promise to be little more than one-tenth those of 1891, the year of the largest importation of tin plate into the United States.

The Current Supplement.

The current SUPPLEMENT, No. 1337, has an interesting collection of articles. The first subject treated is "Objects and Methods of Investigating Certain Physical Properties of Soils," and deals with important forms of scientific apparatus. There are several chemical articles dealing with various subjects. "A Century of Civil Engineering" is by J. J. R. Croes. "Thais and Serapio" is an interesting archæological article. "The Suppression of Tuberculosis" is by Prof. Robert Koch, and his views tend to revolutionize our ideas regarding this dread disease. "American Locomotives in England.—I." is the first instalment of a series of articles which has been attracting great attention. "School Room Temperature and Humidity" is an address by W. G. Bruce.

Contents.

(Illustrated articles are marked with an asterisk.)