

MR. WILLIAMSON'S letter in NATURE of May 27, in which he criticises the attitude of Prof. Soddy and that of the National Union of Scientific Workers towards the Department of Scientific and Industrial Research and the struggling research associations, confuses the issue. To attack the Department or association entrusted with industrial research is tantamount neither to attacking industrial research nor to making invidious distinctions between pure and applied research.

In the minds of the members of this union there exists no belief in the superiority of pure science over industrial research; it has always been our expressed opinion that there is no difference in their scientific value. In one of our explanatory pamphlets this view is expressed: "It [the union] aims at including within a single scheme both academic and technical members. . . . The separation of science and industry has been a principal cause of our disastrous neglect of science in the past, and if continued will remain harmful to both in future. The present organisation, by ensuring the intercourse of the two sides, is therefore desirable on both national and scientific grounds." Embodied in our rules we have as avowed objects: (1) To advance the interests of science, pure and applied, as an essential element in the national life. (2) To promote and encourage scientific research in all its branches.

Our criticism is that in any scheme put forward by the Department inadequate facilities are given to that type of research which, though it has less immediate application, is probably of greater ultimate importance through leading to the better understanding of more phenomena. It would be quite unfair to expect particular industrial research associations to contribute more than others to the prosecution of research which might have a common application to industry or to some aspect of the national life. Obviously this type of work is best carried out at the universities or at institutions such as the National Physical Laboratory. Yet how is this research fostered at the universities? According to the last report of the Department, sixty-eight research workers and their assistants and thirty-five students in training received allowances and grants for equipment amounting to 14,170l.; this is at the rate of 53s. a week, and includes equipment. Contrast this grant with the salary of 4000l. a year for the director of the Glass Research Association—an appointment which is an affront to all scientific workers. Millions have gone into State-protected industries to the accompaniment of an astounding appreciation in the value of the shares held by individuals in the State-aided industry. But the universities are begging for funds to provide decent bench accommodation and instructors for their science students. Speaking at Liverpool on May 28, Dr. Adams is reported to have said that if the university raised the salaries of its demonstrators to a proper standard it would lead to bankruptcy.

It is unfair to suggest that we are criticising the Department for the starvation of pure scientific research because industrial research is fostered; on the contrary, we are anxious for the advancement of both. We are of the opinion that neither branch of science is receiving adequate support, but that research carried out in the general interest is in the more unfavourable position. If we attack the Department it is because we honestly believe it is for the betterment of research—a maximum of efficiency in the administration of the funds available which must inevitably tend towards the better appreciation of science.

At the conference of research associations held under the auspices of the Department of Scientific and Industrial Research on May 14, I heard several

representatives express opinions almost identical with those of the National Union of Scientific Workers; suggestions were made and questions asked which are provoked by Prof. Soddy's address. Mr. Williamson himself dealt with the economic position of the research workers, and made suggestions for improvement which might have been those of a member of the executive of this union.

We entirely concur with Sir Frank Heath that the Department of Scientific and Industrial Research is embarked on a great adventure. Mr. Williamson will agree that it is our concern to work for the safety, honour, and welfare of the adventurous scientific workers. So far we have heard too much of the rights of the financial interests concerned to work out their own salvation with money provided largely by the State, but very little of the rights of the scientific workers to safeguard their own interests. We wish to be assured that the leading spirit in the adventure is sufficiently well advised to guide him in his choice of officers for this army of truth-seekers, and that his army is not defeated by ignorance, mishandled by an unsympathetic staff, or starved to feed the parasites of science.

A. G. CHURCH,

Secretary.

National Union of Scientific Workers,
10 Tothill Street, Westminster, London, S.W.1, May 31.

The Great Red Spot on Jupiter.

WHEN this remarkable object came into striking prominence and attracted general observation in 1878, the rate of its rotation period was slightly increasing, and it continued to increase until the end of the century. Then in the early part of 1901 a large irregular spot appeared in the south tropical zone of Jupiter. This new feature, moving swifter than the red spot to the extent of about 23 seconds per rotation, soon affected the motion of the latter by accelerating its rate as it overtook it, and this influence has been repeated prior to the seven occasions on which the two objects have been in conjunction during the last twenty years.

The rate of rotation indicated by the red spot has, in fact, been a very variable feature in recent times, and the marking named has exhibited an increased velocity and a shortening period. In the years from 1894 to 1901 the mean period was 9h. 55m. 41.3s., but in the last eight years it has been 9h. 55m. 35.7s.

I have shown the annual differences in Fig. 1, and the rate of rotation determined each year I have also tabulated for inspection and comparison:

	h.	m.	s.		h.	m.	s.
1878	...	9 55	33.7	1899	...	9 55	41.6
1879	...		34.1	1900	...		41.4
1880	...		35.2	1901	...		40.7
1881	...		36.3	1902	...		39.6*
1882	...		37.3	1903	...		40.2
1883	...		38.2	1904	...		39.7*
1884	...		39.0	1905	...		41.2
1885	...		39.6	1906	...		39.5*
1886	...		39.9	1907	...		40.9
1887	...		40.1	1908	...		39.6*
1888	...		40.2	1909	...		40.3
1889	...		40.4	1910	...		37.4*
1890	...		40.5	1911	...		37.4
1891	...		40.6	1912	...		37.2
1892	...		40.8	1913	...		34.8*
1893	...		40.9	1914	...		35.5
1894	...		41.0	1915	...		37.5
1895	...		41.1	1916	...		36.4
1896	...		41.3	1917	...		34.5
1897	...		41.5	1918	...		33.7*
1898	...		41.7	1919	...		35.5

The values are smoothed up to 1900, but not in later years.

I have placed an asterisk in the table and diagram to those years in which a conjunction occurred between the red spot and the south tropical spot. In every case it will be seen that the red spot moved at a more rapid rate in those years when conjunctions were observed.

The south tropical spot or disturbance is a totally different object both in form and nature, and probably in origin, from the great red spot. The latter has preserved its symmetrical oval form since it was observed by Dawes in 1857, but the former has varied enormously in its length and detail. In 1901 it was scarcely more than 20° long, in 1902 July 87° , in 1903 48° , in 1905 44° to 60° , in 1911 115° , in 1912 65° , in 1913 March 140° , and in 1918 180° , so that in the last-mentioned year it extended half-way round the vast diameter of Jupiter.

This marking exhibited undue faintness in 1918 and the early part of 1919, and it appeared to be on the eve of disappearing, like the hollow in the great south equatorial belt where the red spot lies. How-

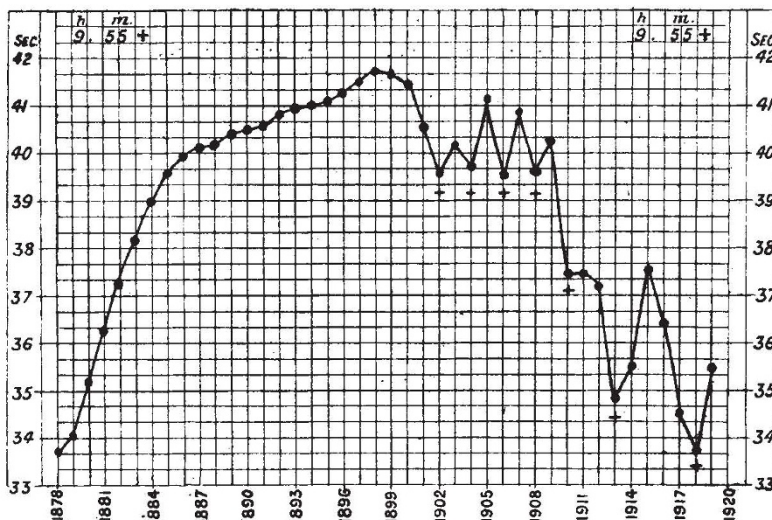


FIG. 1.—Rates of rotation of the Great Red Spot on Jupiter.

ever, there has recently been some intensification in the material forming the south tropical spot, so that observations are being made to trace its position and developments. It is satisfactory also to know that the red spot itself continues to retain its definite form, and is sufficiently distinct to be within easy recognition when a steady air conduces to good seeing. This spot seemed to be breaking up or wearing out early in 1919, but it has recovered something of its old-time aspect, and is well within reach of the telescopes usually in the hands of amateurs.

Since Schwabe first saw the hollow on the south side of the great south equatorial belt of Jupiter in 1831 September 5, the planet has rotated more than 78,000 times. There is every reason to conclude that the object he saw is the same as that which has been so prominently visible in recent years in close contiguity to the red spot. The two features appear to have participated in one and the same fluctuating rate of rotation, a mean of which was $9h. 55m. 36.8s.$ during the $88\frac{1}{2}$ years included in the observations.

The observations upon which my deductions for recent years are based were made by the Rev. T. E. R.

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Phillips and Mr. F. Sargent, and I take this opportunity of acknowledging their kindness in furnishing the necessary materials. My abstention from planetary work has been practically enforced, but, amid the regret caused thereby, I feel great satisfaction in the fact that others are pursuing it with much ability and energy.

W. F. DENNING.
Bristol, May 11.

British and Foreign Scientific Apparatus.

Now that we are living in an age of "trusts" there is no need to fear foreign competition in respect to prices. The only points our home manufacturers should lay stress upon are quality and quantity, and should these be maintained at a high level they can hold their ground against foreign manufacturers; that is, so long as the manufacturers throughout the world have confidence in their respective associations. Whenever these commercial associations begin to fall asunder we may expect competition in prices to operate, and then it will mean a commercial war, not between nations, but between individual manufacturers in Europe and America. The result will mean financial benefit to the users of scientific apparatus, just as the recent slump in prices of the necessities of life may soon prove to be advantageous to consumers generally throughout the world.

Scientific apparatus is as necessary to the maintenance of healthy life as are hygienic clothing and wholesome food; and if protection for British manufacturers is required in the form of prohibition except under licence to induce them to improve the quality and the output, with the ultimate object of developing an optical industry within the Empire of such importance that there would be less danger to the State in the event of another war, why should the users of scientific apparatus be expected to bear the hardships in regard to poorer quality and higher prices even for a temporary period? Surely it is a question for the Government to decide as to what amount of State aid is required to develop a key industry that the whole nation may be called upon to bear the expense instead of an extremely small minority of the population.

In pre-war days our principal foreign competitor was Germany, not so much in price as in quality, and if German manufacturers were able to develop an industry of very considerable importance without State aid, why cannot British manufacturers do likewise?

There was one person in Germany who was more responsible than all other makers together in lowering prices, viz. Leitz of Wetzlar. He always appeared satisfied with a comparatively small profit, and aimed at a very large output; and, I believe, he was the first to sell $1\frac{1}{12}$ -in. oil immersion objectives at $5l.$, and curiously this ultimately became a uniform price throughout the trade in Europe and America. The same maker sold students' microscope stands at $55s.$, which, with suitable optical equipment, was a serviceable instrument with highest magnifications. The prices of these articles to-day are $9l.$ and $8l. 5s.$ —higher than the British equivalents.

Since the armistice German manufacturers have