

contract, and unfortunate explosions wrecking the first two devices constructed, this work has been delayed. However, it is probable that further tests may present more satisfactory results.

5. A valuable report was contributed voluntarily by John A. Roebling's Sons Co., on the subject of wire terminals for aeroplane construction. Their report, while not complete, is in very satisfactory form, and shows that it is possible to obtain 100 per cent efficiency of terminal construction with hard wire, strand, and cable. The point is raised that the efficiencies of the different types of wire trussing, based on weight for strength, are in the order of wire, strand, and cable, and it is therefore not clear why there appears to be a general preference in this country and abroad for the use of strand and cable, and it appears that other factors than those considered in the investigation must be of importance, the probable factor being that of elasticity, though no definite reasons for such preference were presented.

6. The Advisory Committee instituted an investigation as to the facilities available in different colleges, technical institutions, engineering institutions, and among manufacturers and various aeronautic societies, for the carrying out of aeronautic investigations. It found that limited facilities were available for attacking various problems of aeronautic design, and that they could be made available to the committee, provided sufficient funds were available to carry out the necessary experiments, or to engage competent engineers on different phases of the work. A large number of colleges have available mechanical laboratories and engineering courses capable of application to aeronautics, but only the Massachusetts Institute of Technology and the University of Michigan so far offer regular courses. Worcester Polytechnic Institute has conducted experiments on full-sized propellers mounted on a whirling table turning on a pivot in the middle of a pond. The arms of the whirling table are provided at one end with a dynamometer for measuring the torque and thrust and revolutions of the propeller, and at the center a control stand for controlling the speed of the propeller. The speed of the rotating arm is controlled by means of a drag in the water, attached to the opposite end of the rotating arm. While there are objections to this method of testing in a circular path in the open, the method is ingenious and the results obtained should be valuable, particularly for comparison. In general, however, it appears that the interest of colleges is more one of curiosity than that of considering the problem as a true engineering one, requiring development of engineering resources, and, therefore, not yet of sufficient importance to engage their attention, except in a fundamental way. Manufacturers, naturally, are principally interested in the development of types which will meet Government requirements, or popular demand, but which will not involve too radical or sudden change from standard types.

7. It was found that the Bureau of Standards is well equipped for carrying on all investigations involving the determination of the physical factors entering into aeronautic design, and is prepared to take up such matters as are of sufficient general interest to warrant same. The bureau had already prepared, but not published, a paper on the subject of Pitot tubes with reference to their use for air speed meters. This paper was prepared by Professor Herschel and Dr. Buckingham. It was submitted to the executive committee in rough form, and the Bureau of Standards is now placing it in form for publication by the committee. It gives an interesting

description of the investigation of the properties of different types of air speed indicators.

8. The Navy Department is equipped with a model basin and wind tunnel at the Washington Navy Yard, with adequate shop facilities for carrying on the work in a limited way, and is also constructing at the Washington Navy Yard a plant for the testing of aeronautic motors and devices involved in their operation, which will be in commission at an early date. Also, under the Navy Department steady progress is being made in attacking practical problems involved in the development of the Navy aeronautic service at its station at Pensacola, and theoretical and practical design are in hand in the Bureaus of Construction and Repair and Steam Engineering.

9. The War Department has limited facilities at the flying school at San Diego, for investigations of interest to that branch of the service, and is able to carry out in a limited way experiments of interest to the service on full sized machines, for which work it has the assistance of technical experts.

10. The Weather Bureau is well equipped for the determination of the problems of the atmosphere in relation to aeronautics, and Professor Marvin, a member of the Advisory Committee, is the chairman of a subcommittee engaged on this problem. The work, however, is limited until the necessary funds for more extensive work become available. There is already available in the records of the bureau much information of value which requires compilation in a form suited to aeronautic requirements, and this work will be the subject of a preliminary report to be included in the annual report of the committee.

11. The Smithsonian Institution has been engaged for a number of years on the compilation of the bibliography of aeronautics, and is prepared to continue this work for at least two years more with the funds at its disposal. The Institution has also contributed funds toward the development of the work of the subcommittee of the Weather Bureau in its investigation of the problem of the atmosphere in relation to aeronautics.

#### SPECTRUM AND TEMPERATURE OF THE SOLAR PHOTOSPHERE.<sup>1</sup>

By A. AMERIO.

[Reprinted from Science Abstracts, Sec. A, Oct. 25, 1915, § 1389.]

This lengthy and exhaustive monograph gives a detailed account of the author's researches in this domain. The object of the investigation is set forth and the spectrophotometric arrangement employed is illustrated. It is impossible in a short abstract to cover the whole ground, but a few of the more important results may be referred to. The observations were made in 1908-1911 at 4 stations, namely Rome, Alagna, Col d'Olen, and Capanna Regina Margherita, the atmospheric absorption being calculated by imagining the atmosphere to be divided into 4 strata and assigning separate coefficients to each station, according to its elevation. From the total observations it is deduced that the radiation reaching the earth at the upper limit of the atmosphere, from the center of the solar disk is 2.51 gm. cal. per sq. cm. per min. From this and from the data as to the energy distribution on the solar disk the solar constant 2.09 can be deduced. But the solar atmosphere has the effect of reducing the energy radiated by the photosphere in the ratio 150:100; so that the value of the solar constant if

<sup>1</sup> Mem., Accad. Lincei, 1914, 9, No. 9, p. 323-383.

there were no solar atmosphere would be  $2.51 \times 1.50 = 3.76$ , which is the photospheric solar constant  $A_1$ . The absorption of the solar atmosphere ranges from 33 per cent at angle  $0^\circ$  to 68.7 per cent at  $90^\circ$ ; the mean being 44.4 per cent. Applying Stefan's law, this gives a temperature of  $6830^\circ\text{C}$ . for the solar photosphere. The author's values for the solar atmospheric absorption for rays of different wave-length, agree well with those of Abbot and Fowle; but the values of  $q$  not so well. As regards the spectrum of the photosphere, this is found to be very similar to the spectrum of a black body having the same temperature. The apparent distribution of the total energy over the sun's disk varies with the altitude above sea-level. Finally, since a black body at  $6900^\circ$  will yield 5 per cent of its energy in the form of light, by assuming 20 candles to be obtainable per watt at  $7000^\circ$  we arrive at the figure 150,000 candles per sq. cm. for the luminous intensity of the photosphere; that of the sun's disk is considerably lower, the mean intensity being about 67,000 candles per sq. cm. of surface.—*L. H. W[alter]*.

#### EFFECT OF ULTRA-VIOLET LIGHT ON THE EYE.<sup>1</sup>

By W. E. BURGE.

[Reprinted from Science Abstracts, Sec. A, Aug. 30, 1915, § 1029.]

Cataract is known to be prevalent in the tropics among glass-blowers and among elderly people. The most plausible explanation of the opacity of the eye-lens is that it is due to coagulation of the lens protein, just as egg-white and other proteins may lose their transparency when acted on by certain chemicals or exposed to heat. To test the possible effect of radiation in this respect, excised pig and ox lenses were exposed to an electric furnace, being almost submerged in open vessels containing egg-white, blood serum, aqueous and vitreous humor respectively. When the exposed lenses and media were placed in a tank of running water (with the mouth of vessel slightly above its surface), even an exposure of 100 hours failed to produce any opacity. In other cases in which the media were placed very close to the furnace opacity occurred, but the temperature of the lens had risen to  $80^\circ\text{C}$ ., and the conclusion was drawn that this [temperature], and not the red or the infra-red radiation, had caused the coagulation. Exposures to the visible spectrum gave rise to similar results. The filament of a 2000-c. p. gas-filled lamp was focused on the lenses, but exposures for as much as 100 hours gave rise to no opacity. On the other hand, opacity could be produced in a few minutes by focusing the image of the sun on the lenses; but in this case also the rise in temperature was sufficient to account for the coagulation. Similar experiments regarding the effect of ultra-violet light were made. A Cooper Hewitt (2500-c. p.) quartz-tube mercury lamp was used. At a distance of 5 cm. below the tube coagulation of egg-white and blood-serum occurred after 20 minutes' exposure, but the lenses were unaffected even after 100 hours, the aqueous humor was still clear and the vitreous humor only slightly clouded. This is interesting, since practically all other protein substances can be coagulated by ultra-violet light.

Now the author, by the analysis of cataractous eyes obtained from India, has found a great increase over the normal in the percentage present of certain chemicals. For example, eyes from India contained appreciable

amounts of silicates of potassium and calcium; and in other cases various salts of these metals and of magnesium have been found. The presence of these materials therefore seems to render the protein liable to coagulation. This was confirmed by the author, who repeated the exposure to ultra-violet light on lenses immersed in solutions of magnesium chloride, sodium silicate, and dextrose. Turbidity and even total opacity could be produced in these circumstances. The conclusion would seem to be that certain conditions of health, which give rise to abnormal quantities of such materials (those suffering from diabetes, for example, accumulate increased amounts of dextrose), also predispose the eyes to cataract.

There are thus two distinct factors: (1) the presence of these substances which modify the lens-protein, and (2) continual exposure to rays of short-wave length by which the modified protein may be precipitated. The effective region in the spectrum of the quartz lamp appears to be from  $265\mu$  to  $302\mu$ , the former being the point of greatest activity.—*J. S. D[ow]*.

#### ROTATION OF SOLAR CORONA.<sup>2</sup>

By J. BOSLER.

[Reprinted from Science Abstracts, Sec. A, Aug. 30, 1915, § 989.]

During the eclipse of the sun on 1914 August 21, photographs of the spectrum of the corona were obtained with a 3-prism spectrograph giving a dispersion of 1 mm. = 32 Å. The eclipse was notable in that the chief corona line in the green region at  $\lambda 5303$  was extremely faint, and in consequence determinations of the rotation have been confined to measurements of the new line discovered in the red at  $\lambda 6374.5$ . Wave-length determinations were made from comparison spectra of the ordinary sunlight 10 minutes after totality. Taking into account that the slit was inclined  $18^\circ$  to the solar equator, the resultant velocity of rotation of the corona gives an equatorial velocity of 3.9 km. per second. This result is in good agreement with that obtained by Campbell in 1898.—*C. P. B[utler]*.

#### ROTATION OF SOLAR CORONA.<sup>3</sup>

By H. DESLANDRES.

[Reprinted from Science Abstracts, Sec. A, Aug. 30, 1915, § 989.]

The importance of finding any definite value for the rotation of the solar corona is discussed from the point of view of its bearing on the theory of the constitution of the corona. Widely different values of the strength of the solar magnetic field have been obtained in different regions—a feeble value of  $10^{-7}$  gauss by Deslandres, for the region of the high prominences, and a strong value of 50 gauss by Hale for the lower layers of the solar atmosphere. If the coronal radiation is of the nature of electrified particles being projected outward, it would be reasonable to expect some influence on their velocity owing to their passage through the electric field, and this would modify to that extent the measures of the rotation velocity by line-of-sight measurements at the limb. It is suggested that in the future it would be better to arrange for an artificial comparison spectrum instead of using sunlight.—*C. P. B[utler]*.

<sup>1</sup> Elect. World, April 10, 1915, p. 912-914.

<sup>2</sup> Comptes Rendus, April 6, 1915, 160: 434-437.

<sup>3</sup> Comptes Rendus, April 6, 1915, 160: 437-440.