bridge, contains particulars of many interesting, and some scarce, works in anthropology, archæology, folk-lore, mythology, botany, geology, mathematics, astronomy, and physics. We notice in the astronomical section a set of the *Astrophysical Journal*, and the "Nautical Almanac" for 1875–1916.

OUR ASTRONOMICAL COLUMN.

RELATIVITY AND GRAVITATION.—According to the original form of the theory of relativity, an absolute velocity v in space cannot be determined by any physical means, all matter as well as electrical and optical fields being contracted, in the terminology of the older physics, in the same ratio $(1-v^2/c^2)^{\frac{1}{2}}$. Using the same terminology, Einstein's recent gravitational theory requires a gravitational field to suffer contraction in this same ratio, so that an absolute velocity v must remain for ever hidden from our knowledge. Einstein has shown that this theory, suitably generalised to cover independently-moving bodies, leads to changes in the perihelia and eccentricities of the four inner planets which agree well with those observed. In the *Phil. Mag.* for August Sir Oliver Lodge suggests an alternative explanation of the changes in Mercury's orbit. In accordance with pre-relativity theory, the mass of Mercury, when moving with velocity v, is supposed to be $m_0(1-v^2/c^2)^{-\frac{1}{2}}$; of this only the stationary mass m_0 is supposed subject to gravitation, while the sun's gravitational field is not supposed to suffer distortion as it moves through space. The assumed increase in inertia, uncontrolled by gravitation, is found to lead to a revolution of Mercury's orbit in its own plane, which will agree with that observed if the sun has a velocity of about 68 km. a second towards longitude 294°. This velocity would also give an apsidal progression for Mars about equal to that observed, but in the September *Phil. Mag.* Prof. Eddington has shown that it would give orbital distortions for the earth and Venus enormously greater than those observed. In these papers no allowance is made for the distinction between longitudinal and transverse electromagnetic mass, but it seems impossible that this correction could reconcile theory with observation; indeed, the discussion suggests that no theory of the general type suggested by Sir Oliver Lodge can be made to fit all the facts, so that the relativity theory appears to be left in a stronger position than ever.

PHOTOGRAPHS OF NEBULÆ.—A remarkable collection of photographs of nebulæ taken with the 60-in. reflector of the Mt. Wilson Observatory has been published by Mr. F. G. Pease (*Astrophysical Journal*, vol. xlvi., p. 24). The objects selected were in general nebulæ of unknown structure, or nebulæ which were known to exhibit unusual features. Most of the exposures were made with aperture ratio F/5, but several of the bright planetary nebulæ were also photographed with the 80- and 100-ft. focus Cassegrain arrangements of the telescope, in order to give a larger scale. The exposures ranged from ten minutes to seven hours. It is interesting to note that the perfection of the photographs was increased in the case of very long exposures by the use of two guiding stars, which allowed of correction being made for variation in size and for rotation of field produced by refraction and imperfect adjustment of the telescope. In addition to the sixty-five nebulæ which are fully described, attention is directed to others which appeared incidentally on the plates, and to a number of uncatalogued nebulæ and nebulous stars. The photographs show a great amount of intricate detail, and bear witness alike to the excellence of the instrument and the skill of the observer.

THE 100-IN. REFLECTOR AT MOUNT WILSON.—An illustrated description of the great reflector of the Mount Wilson Observatory is given by Mr. Pease in the *Scientific American* for August 11. As supplementing the account already given in the columns of NATURE of July 12 (vol. xcix., p. 385), it may be noted that the moving parts of the telescope, which is mounted on the English pattern, weigh 100 tons. The greater part of the weight is taken up by the mercury flotation system, 40 tons at the north pedestal and 60 tons at the south pedestal. The driving clock is regulated by an isochronous governor of the conical pendulum type, and the weight is wound up automatically at intervals of twelve minutes without interference with the driving. The clock itself stands 6 ft. high and occupies a floor space of $5\frac{1}{2}$ ft. by 4 ft. The actual diameter of the mirror is 101·2 in., and its focal length 507·5 in., giving an aperture ratio of 5·05. Elaborate arrangements have been made to maintain the mirror at constant temperature by water circulation. Manipulation of the dome and telescope involves the use of forty motors of 1/20 to $7\frac{1}{2}$ horse-power, with an aggregate of 50 horse-power and more than thirteen miles of wiring. It is estimated that about 300 million stars will be within range of the new instrument.

INDUSTRIAL FATIGUE.[1]

UNDER the above title Prof. Spooner has collected articles written by him in 1916 for publication in *Co-partnership*. The pamphlet is a useful contribution to the discussion of reconstruction, which already is receiving anxious attention from many who realise its extreme importance and its extreme difficulty.

Evidently in so small a space but few details can be given, but the author has touched upon many points which show how wide is the problem and how great are the difficulties which surround it. Perhaps the main impression left upon the mind after a perusal of these fifty-nine pages is one of the immense amount of scientific investigation which remains to be done before industrial processes—to say nothing of industrial management can be placed on a thoroughly satisfactory footing. It is only quite recently, and largely on account of present conditions, that the general public and directors of industry have begun to realise that science after all is merely crystallised and systematised knowledge, and that to attempt to conduct industrial processes without it is to dispense with one of the greatest aids to success. Now, however, the leaven is spreading. Many firms operating processes which depend on scientific principles have their own scientific staff working in admirably equipped laboratories, and so far as their own processes are concerned little more is needed, though it would undoubtedly contribute to the general advance if the results of the investigations carried out could be made available for all to profit by. But apart from these questions there are larger problems which affect all industries, and which can only be dealt with effectively by some central authority. Such, for instance, is the question of the number of hours' work per week which will enable an operative to produce the largest output without injurious fatigue. Evidently no general answer can be given to such a question. The answer must vary with conditions, and all conditions must be studied in order that their influence in producing fatigue may be determined. But certain fundamental facts may be established, and perhaps the most im-

[1] "Industrial Fatigue in its Relation to Maximum Output." By Henry J. Spooner, C.E. Forewords by Sir Robert Hadfield, F.R.S., and Mr. J. R. Clynes, M.P. (Co-partnership Publishers, Ltd., 6 Bloomsbury Square, W.C.1.) Price 6*d.* net.