

To test the question as to whether the vortex of air about the mirror had any effect on the deflection, the speed was lowered to 192, 128, 96, and 64 turns per second. If the vortex had any effect, it should have decreased with the lower speed, but no such effect could be detected.

Finally, to test if there were any bias in making the observations, the readings in several sets were taken by another, and the results written down without divulging them. The separate readings, as will be shown in the following specimen, were as consistent as when made by myself, and the final results agree with those of other observations:—

*Specimen of Observations*

June 17, Sunset. Image good (best in column 4).

(1)	(2)	(3)	(4)	(5)
112'81	112'80	112'83	112'74	112'79
112'81	112'81	112'81	112'76	112'78
112'79	112'78	112'78	112'74	112'74
112'80	112'75	112'74	112'76	112'74
112'79	112'77	112'74	112'76	112'77
112'82	112'79	112'72	112'78	112'81
112'76	112'73	112'76	112'78	112'77
112'83	112'78	112'81	112'79	112'75
112'78	112'79	112'74	112'83	112'82
112'82	112'73	112'76	112'78	112'82

Means = 112'801    112'773    112'769    112'772    112'779  
 Zero = 0'260       0'260       0'260       0'260       0'260

$d = 112'541$      $112'513$      $112'509$      $112'512$      $112'519$   
 Temp. =  $77^\circ$ ,  $B = +1'500$ , cor. =  $-0'144$ , diff. =  $+1'356$ ,  
 added to  $256'070 = 257'426 = n$   
 $28'155 = r$

Results from the above.

299,660    299,740    299,740    299,740    299,720

*Data for Working out Observations*

- Ut<sub>3</sub> fork makes 256'070 vibr. per sec. at 65° F.
  - D = 3,972'46 feet.
  - tan α = tangent of inclination of plane of rotation = 0'02.
  - c<sub>1</sub> = log = 0'51457.
  - c = log = 0'49670.
  - d = deflection as read from micrometer.
  - r = radius.
  - φ = angle of deflection.
  - n = number of revolutions per second.
  - V = velocity of light in kilometres.
  - B = number of beats per second between electric Ut<sub>3</sub> fork and standard Ut<sub>3</sub> fork. Electric fork makes  $\frac{1}{2}(256'07 + B + \text{cor.})$  vibr. per second, and n is a multiple submultiple or simple ratio of this.
  - Cor. = correction for temperature of standard, =  $-0'012$  v.s. per degree F.
- |                                 |                                |
|---------------------------------|--------------------------------|
| Mean result <sup>1</sup> ... .. | 299,728                        |
| Cor. for temp. ... ..           | +12                            |
| Vel. of light in air ... ..     | 299,740                        |
| Cor. for vacuum ... ..          | +88                            |
| Vel. of light in vacuo =        | 299,828 kilometres per second. |

SCIENTIFIC SERIALS

*American Journal of Science and Arts*, November.—Mr. Stockwell, who has been systematically examining the physical theory of the moon's motion, here calls attention to a secular inequality in that motion, produced by the oblateness of the earth. For attracted points out of the plane of the equator, and not beyond the parallels of 35° 16' (which is the moon's case), the attraction of the earth is less than it would be if the latter were spherical. The author says he has found several inequalities in the moon's motion, not recognised by existing theories, and of even greater practical importance than the foregoing.—The diamagnetic constants of bismuth and calc-spar in absolute measure have been determined by Prof. Rowland and Mr. Jacques. In their paper the former develops mathematical expressions for the various coefficients of magnetisation, while the latter describes the experimental method adopted: first, exploration of the field, and then noting the time of swing of

<sup>1</sup> In the original a table of observations appears which we are obliged to omit for want of space, while we give the result of the same.

little suspended bars of the substances in it. The constants for bismuth are

$$\left\{ \begin{aligned} k_1 &= -'000000012554 \\ k_2 &= -'000000014324 \end{aligned} \right\};$$

for calc-spar,

$$\left\{ \begin{aligned} k_1 &= -'000000037930 \\ k_2 &= -'000000040330 \end{aligned} \right\}.$$

—Mr. Gibbs's elaborate paper on vapour-densities is here concluded. The relation between temperature, pressure, and volume for the vapours of peroxide of nitrogen, formic acid, acetic acid, and perchloride of phosphorus, differs widely from that expressed by the usual laws, and the hypothesis of a compound nature of the vapour is probable. Mr. Gibbs had proposed equations to express the relations between temperature, pressure, or volume, and quantities of the components in such a "gas mixture of convertible components." In his paper he reviews all known experimental determinations of the vapour densities, and finds fair agreement with formula.—We note also accounts of Mr. Michelson's recent experimental determination of the velocity of light; of the remarkable Kane Geysers well (arising from a conflict between gas and water in a petroleum region), and of Mr. Edison's resonant tuning fork.—Besides Prof. Marsh's recent address, there are further notes by him of new Jurassic mammals from the Rocky Mountains, showing a resemblance to known types of the Purbeck in England.

*The American Naturalist*, vol. xiii. No. 11, November, contains:—B. B. Redding, How our ancestors in the Stone Age made their implements; Isaac C. Martindale, Colorado plants; C. G. Siewers, Mould as an insect destroyer; W. N. Lockington, Notes on Pacific Coast fishes and fisheries; William Trelease, On the fertilisation of our native species of *Clitoria* and *Centrosema*; Recent Literature; General Notes; Scientific News; Proceedings of Scientific Societies.

*Annalen der Physik und Chemie*, No. 10.—A useful paper by Herr Fromme, in this number, treats of the electromotive force of the Grove, Bunsen, and Daniell batteries, as related to concentration of the liquids. The force of a Grove, whenever this cell is traversed by a very weak current, decreases continuously with concentration of nitric acid and approximately in proportion. That of the Bunsen, under like conditions, is, for the higher concentrations, about equal to that of the Grove, but from a concentration C = 55 greater, because it remains constant, while the decrease in the Grove goes on. The force of the Grove increases with increased concentration of the sulphuric acid to a maximum between C = 25, and C = 35, and thereafter decreases at a more rapid rate.—Herr Kundt and Herr Röntgen have succeeded in proving electromagnetic rotation of the plane of polarisation in several of the less easily condensed gases; and quantitative results for air, hydrogen, oxygen, carbonic oxide, and marsh gas, are here given. The rotation is in direction of the positive current (as with water and sulphide of carbon), and its amount is approximately proportional to the density. It is estimated that 253 km. air in the north-south direction would give a rotation of 1°. The author's apparatus (including a means of compression to about 250 atm.) is described.—Prof. Lommel contributes two papers; in one of them, on Newton's dust rings, he seeks to show the adequacy of the diffraction-theory to explain the phenomena, as against the diffusion theory (interference of diffusely reflected light); in the other paper, on Stokes's law, he controverts M. Lamansky's experimental support of the general validity of this law, which he (Prof. Lommel) had before impugned, as inapplicable to a certain "critical region" in which the fluorescence and absorption-spectra overlap.—Herr Willner describes a five-band spectrum of oxygen obtained both from the positive and the negative light in spectral tubes, to which was admitted oxygen produced by electrolysis. When the charge of gas was allowed to stand a quarter to half an hour, the spectrum was changed into that of carbon.—Herr Narr endeavours further to show that the loss of electricity by an insulated body in a gas cannot alone be explained by rise of temperature of the gas, or conduction through the insulating supports, or the presence of particles of foreign substances, as dust, water, or mercury vapour. Nor is there, apparently, a special conductivity of the gas in the ordinary sense.—The changes of density produced in steel by hardening and annealing, are indicated by Herr Fromme.—Herr Riecke has a mathematical paper on the doctrine of the poles of a bar-magnet; and Herr Gerland shows historical reason for believing that the caloric engine was conceived by Leibnitz in 1706, and that Papin is alone the inventor of the centrifugal pump.