

necting-rod was disconnected, and the piston was rigidly blocked at the end of the stroke furthest from the crank, the interior of the cylinder surrounding the piston-rod being entirely filled up with wood and iron packing. The steam passage between the valve seat and the end of the cylinder next the crank was also solidly filled up; and the port itself was closed by a brass plate scraped down to the level of the valve seat. The port admitting steam to the end of the cylinder furthest from the crank was left open; and the crank shaft, eccentric, and valve were driven by another engine. The steam pressure in the boiler was maintained at a uniform amount, and the regulator was kept open during a trial. The steam was measured by connecting the exhaust port with a surface condenser and collecting the resulting water. The results of the experiments appeared to indicate that the net initial condensation, or excess of condensation, over re-evaporation by the clearance surface varies directly as the initial density, and inversely as the square root of the number of revolutions per unit of time. The paper was discussed, and was followed by one on irrigating machinery on the Pacific coast, by Mr. John Richards, which dealt very fully with the forms of pumps required for the various services to be performed. The discussion of this paper was adjourned.

PARIS.

Academy of Sciences, September 26.—M. Hervé Mangon in the chair.—On the recent waterspout in Lake Geneva, by M. H. Faye. In reply to M. Ch. Dufour's letter stating that several persons had noticed an ascending gyrotory movement in the waterspout that swept over Lake Geneva on August 19, the author points out that, although the movement is really descending, as he holds against most meteorologists, there is nothing remarkable in this apparent contradiction, which is due to a purely optical illusion on the part of the observers. In the same way the spirals of a vice or screw, placed vertically to a horizontal base, when turned in the reverse direction, seem to the spectator to ascend along the line of the main axis, presenting the appearance of continually retiring from the base upwards, and burying itself in the handle or top cross-piece. The cause of the illusion is simple enough. Each anterior semi-spiral is successively replaced, as the screw revolves, by the posterior half, which, being at a higher level, the visible half-spirals, taken separately and together, seem to ascend. So with waterspouts, which, as already repeatedly explained, never ascend, but always descend, being the result of forces having their existence in the upper atmospheric regions.—On the measurement of the forces brought into play in the flight of a bird, by M. Marey. Anatomy shows that nearly all the muscles acting on the wing serve to lower it, while the kinematic data drawn from photo-chronography show that during this lowering of the wing the mass of the bird is upheld against gravity and propelled forward against the resistance of the air, the result being flight. The author here studies these two elements of the motor power separately, whence may ultimately be deduced the sum total of the motor power.—Remarks accompanying the presentation of vol. xiii. of the "Mémorial du Dépôt de la Guerre," by General Perrier. This volume is occupied exclusively with the operations connected with the extension of the geodetic and astronomic lines from Spain to Algeria.—Observations of Brooks's comet (August 24), made at the Observatory of Algiers with the 0.50m. telescope, by MM. Trépied, Rambaud, and Sy. The observations extend over the period from September 10 to 16, and give the positions of six comparison stars of the eighth and ninth magnitudes.—Observations of the same comet at the Observatory of Lyons with the 0.18m. Brunner equatorial, by M. Le Cadet. The observations cover the period from September 13 to September 21.—Positions of Barnard's comet (May 12, 1887) and of Palisa's new asteroid (September 21, 1887), measured at the Observatory of Besançon, by M. Gruy. The observations of the comet run from June 13 to July 23. Those of the asteroid were taken with the 8-inch equatorial on September 23.—On the relative distances of the planets in relation to the sun, and on the distances of the periodical comets, by M. Delauney. The planetary distances being represented by the

formula $D = 86^{1.0669^n}$, where n receives the successive values 1, 2, 3, 4, . . . , the unity of distance is the semi-diameter of the sun, and if this unity be changed and the distance be taken, for instance, of the earth from the sun, the formula becomes

$D = 0.0032680 \times 86^{1.0669^n}$. The calculation shows that with this same unity the mean distances of the six known periodical

comets from the centre of the sun may be one presented by the analogous formula $D = 1.8940 \times 1.1511^{2^n}$. Further considerations show that there exists a gap in the series corresponding to $n = 1$, and that seven comets may be regarded as forming a single group analogous to the minor planets of the solar system. The distances increase so rapidly with n that for $n = 6$ we get 15,455, corresponding to a periodicity of nearly 2,000,000 years. Other considerations lead to the inference that the periodical comets appear to be produced by the cosmic matter of the zodiacal light.—Researches on the spheroidal state, by M. E. Gossart. The author here seeks to determine by calculation and experiment the meridional semi-section of any liquid drop whatsoever in a state of calefaction on a horizontal plaque. It is shown that there exists a characteristic form of the spheroidal state, which may easily be represented graphically according to a given scale. The measurements of the various elements of these curves may furnish useful information on the capillary constant.—On the distillation of citric acid with glycerine, MM. Ph. de Clermont and P. Chautard. The product of the process here described presents absolutely the same properties as the pyruvine obtained by distilling a mixture of tartaric acid with glycerine, although it seems difficult to explain how the same substance should result from the distillation, in the presence of glycerine, of an acid such as citric acid, which differs so greatly from tartaric acid.—On the development and structure of young Orobanches, by M. Maurice Hovelacque. Since M. Caspari's observations on the germination of the Orobanches (*O. cruenta*, *O. ramosa*, *O. minor*, *O. Hederae*), dating from 1854, nothing was published on the subject till its study was resumed by Koch in 1883, the results being published in a comprehensive memoir recently issued by him. In the present communication M. Hovelacque indicates several important points where his own observations differ considerably from the conclusions of the learned German botanist.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Exercises in Quantitative Chemical Analysis, including Gas Analysis: W. Dittmar (Hodge).—Weather Charts and Storm Warnings, 3rd edition: R. H. Scott (Longmans).—Proceedings and Transactions of the Royal Society of Canada for 1886, vol. iv. (Dawson, Montreal).—Report of the Voyage of H.M.S. Challenger, vol. xxi. 2 Parts, Zoology.—An Elementary Treatise on Kinematics and Dynamics: J. G. Macgregor (Macmillan).—Key to Toddhunter's Conic Sections: Edited by C. W. Bourne (Macmillan).—Handbuch der Paläontologie, 2 Abth. Paläozoologie, 3 Band, 1 Liefg. (Williams and Norgate).

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