

inst. Cape Matifan appeared from Algiers close at hand with a sharply cut rock of granite at its extremity. The temperature was $43^{\circ}2$ C. in the shade, showing that the air above the sea was very hot, and that the explanation of the phenomenon is to be found in the same causes as those determining a mirage in the Sahara. The lowering of the temperature was very rapid, falling as much as 2° C. at Bouzarcah Observatory. The 7th inst. was the hottest day that has yet been felt there this season. Lightning struck the Government barrack at Mustapha, and ignited piles of hay, inflicting damage to the extent of 4000l.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*) from India, presented by Mr. F. W. Steward; a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by Mrs. Colclutt; six Prairie Marmots (*Cynomys ludovicianus*) from North America, presented by Mr. F. J. Thompson; two Common Foxes (*Canis vulpes*) from Russia, presented by Mr. Harrison Cripps, F.R.C.P.; a Common Rhea (*Rhea americana*) from South America, presented by Mr. J. W. Bell; four Red-bellied Squirrels (*Sciurus variegatus*) from Trinidad, presented by Mr. R. J. Lichmere Guppy; two Peba Armadillos (*Tatusia peba*) from South America, presented by Mr. J. Clements; a Greater Black-backed Gull (*Larus marinus*), British, presented by Mr. Henry Stevens, M.D.; twenty-four Sand-Lizards (*Lacerta agilis*), a Slowworm (*Anguis fragilis*), a Common Snake (*Tropidonotus natrix*) from Germany, presented by Mr. S. Schaefer; two Sarus Cranes (*Grus antigone*) from North India, eight European Tree Frogs (*Hyla arborea*) from Germany, purchased; two Long-fronted Gerbilles (*Gerbillus longifrons*), an Elliot's Pheasant (*Phasianus ellioti*), a Bronze-winged Dove (*Phaps chalcoptera*), a Barred-shouldered Dove (*Geopelia humeralis*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

SCHULHOF'S RESEARCHES ON THE ORBIT OF COMET 1873 VII. (COGGIA—WINNECKE).—The elements of Comet 1873 VII. bear a certain resemblance to those of Comet 1818 I., which was observed by Pons. Prof. Weiss asserts the identity of these two comets, and adopts sixty-two years as the most probable value of the period of revolution. In the *Bulletin Astronomique*, tome iii. p. 125 *et seq.* M. L. Schulhof has published a most exhaustive discussion of the orbit of Comet 1873 VII., and has gone into the question of its possible identity with 1818 I., as well as with 1457 I. (the observations of which by Toscanelli have recently been discussed by Prof. Celoria) in a most thorough manner. The opinion which he expresses, with some reserve, as the result of his investigations, is that the Comets 1873 VII. and 1818 I. are distinct bodies with a short period of revolution, having a common origin. The Comet 1457 I. is probably identical with 1873 VII., but it is also possible that the two comets, 1873 VII. and 1818 I. are fragments of 1457 I., which must have been a much more conspicuous object than either of them, to have been seen by Toscanelli and by the Chinese with the naked eye.

SOLAR ACTIVITY DURING THE FIRST HALF OF 1886.—The numbers and areas of sunspots have shown upon the whole a decided falling off during the past half-year as compared with the last six months of 1885, although no month of the present year has shown so low a daily average as December 1885. There has been, however, a steady increase in the number of days on which the sun's disk was free from spots, one side of the sun being, on the average, much less spotted than the other, causing an apparent short period in the variation of the spotted area, of about a synodic rotation of the sun in duration. The month in which the mean daily number of sunspots was least was February; that in which it was most was March. An exceedingly fine group was observed on May 8.

Prominences have shown fewer fluctuations in their numbers and size, but have been fully one-fourth less numerous on the average than in 1885.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 JULY 25-31

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on July 25

Sun rises, 4h. 15m.; souths, 12h. 6m. 14'6s.; sets, 19h. 57m.; decl. on meridian, $19^{\circ} 38'$ N.: Sidereal Time at Sunset, 16h. 11m.

Moon (one day after Last Quarter) rises, 23h. 35m.*; souths, 6h. 39m.; sets, 13h. 54m.; decl. on meridian, $11^{\circ} 23'$ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian
Mercury ...	6 50 ...	13 46 ...	20 42 ...	$10^{\circ} 6'$ N.
Venus ...	1 37 ...	9 46 ...	17 55 ...	$22^{\circ} 22'$ N.
Mars ...	10 59 ...	16 35 ...	22 11 ...	$5^{\circ} 18'$ S.
Jupiter ...	9 47 ...	15 54 ...	22 1 ...	$0^{\circ} 32'$ N.
Saturn ...	2 43 ...	10 51 ...	18 59 ...	$22^{\circ} 15'$ N.

* Indicates that the rising is that of the preceding evening.

Occultations of Stars by the Moon (visible at Greenwich)

July	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
27 ...	85 Tauri ...	6 ...	h. m. ...	h. m. ...	$90^{\circ} 22'$
27 ...	σ^2 Tauri ...	5 ...	3 6 ...	3 43 ...	$10^{\circ} 29'$
27 ...	σ^1 Tauri ...	$5\frac{1}{2}$...	3 23 ...	near approach	334° —
July ...	5 ...	Mercury at greatest distance from the Sun.			
28 ...	22 ...	Venus in conjunction with and $0^{\circ} 6'$ south of μ Geminorum.			
28 ...	23 ...	Venus in conjunction with and $3^{\circ} 46'$ north of the Moon.			

Variable Stars

Star	R.A.	Decl.	h. m.
U Cephei ...	0 52'2 ...	$81^{\circ} 16'$ N. ...	July 28, 22 51 m
Algol ...	3 0'8 ...	$40^{\circ} 31'$ N. ...	„ 28, 1 47 m
			„ 30, 22 36 m
δ Libræ ...	14 54'9 ...	$8^{\circ} 4'$ S. ...	„ 31, 21 22 m
R Scorpii ...	16 10'9 ...	$22^{\circ} 40'$ S. ...	„ 31, M
U Ophiuchi ...	17 10'8 ...	$1^{\circ} 20'$ N. ...	„ 27, 23 52 m
W Sagittarii ...	17 57'8 ...	$29^{\circ} 35'$ S. ...	„ 26, 0 0 m
β Lyræ ...	18 45'9 ...	$33^{\circ} 14'$ N. ...	„ 26, 2 0 m ₂
η Aquilæ ...	19 46'7 ...	$0^{\circ} 43'$ N. ...	„ 25, 0 0 M
δ Cephei ...	22 24'9 ...	$57^{\circ} 50'$ N. ...	„ 25, 21 30 M

M signifies maximum; m minimum; m₂ secondary minimum.

Meteor Showers

The principal shower is that of the *Aquarids*, maximum July 28; radiant R.A. 340° , Decl. 13° S. Other showers are as follows:—The *Andromedes* (I.), R.A. 8° , Decl. 36° N.; near χ Persei, R.A. 32° , Decl. 53° N.; near β Ursæ Majoris, R.A. 165° , Decl. 53° N.; and near the Pole, R.A. 300° , Decl. 87° N.

ON LAYING THE DUST IN MINES

IN a paper recently contributed to the South Wales Institute of Engineers,¹ Mr. Archibald Hood, the President, says:—

“It was probably first suggested by Faraday and Lyell about the year 1845 that coal-dust was in some way inflammable. This idea was subsequently set forth by several French engineers, but all that was done previous to the year 1875 bears the same relation to subsequent demonstrations as the steam-engine of Hero of Alexandria bears to the steam-engine of the nineteenth century.”

Assuming Mr. Hood's date to mark correctly the commencement of the real battle between the new theory and its predecessors, it cannot surely be urged that the period of ten years which has since elapsed has been too long wherein to destroy the vast herd of previously existing chimeras, and to introduce and establish a new and different order of ideas. Doubtless the result attained up to the present has been prodigiously accelerated by the labours of the Royal Commission on Accidents in Mines, and of the

¹ “On the Watering of Dusty Mines.” The South Wales Institute of Engineers, March 18, 1886.

similarly constituted bodies in France and Germany, all of which have been called into existence and have completed their labours within the period named. Indeed, scarcely had the ink with which the English Report was written been dry when the Home Office introduced a new Mines' Regulation Bill which provides, amongst other things, that "*In all dry and dusty mines the airways and travelling roads are to be kept clear of dust OR well watered, and a shot is not to be fired until the place and that near it is cleared of dust and then well watered*" ("Mining Journal").

The crudeness of the idea embodied in the first alternative, which appears to contemplate the possibility of removing the dust from roadways and airways without the simultaneous use of water, reminds one of an incident of the interview between Christian and the Interpreter ("Pilgrim's Progress") :—

"Then he took him by the hand and led him into a very large parlour that was full of dust because never swept; the which, after he had reviewed it a little while, the Interpreter called for a man to sweep. Now when he began to sweep the dust began so abundantly to fly about that Christian had almost therewith been choked. Then said the Interpreter to a damsel that stood by, 'Bring hither water and sprinkle the room,' the which, when she had done, it was swept and cleansed with pleasure."

It has all the appearance of being a compromise between efficiency on the one hand and ignorance or prejudice on the other, and closely resembles, in this respect, the first General Rule of the Act for the Regulation and Inspection of Mines, 1860 (23 and 24 Vic., cap. 151), according to which a mine was required to be ventilated only in such a way as to be safe *under ordinary circumstances*. But just as these qualifying words were found to be a cloak for all kinds of inefficiency in the matter of ventilation, and had to be ultimately expunged after a twelve years' trial, so we venture to predict will this other unscientific alternative, if passed into law, cause endless trouble and disaster, and require to be similarly dealt with at some future time.

To lay the dust sufficiently well to prevent the spread of an explosion requires a much smaller quantity of water than appears to be generally supposed.

This has been stated more or less directly several times in describing the results of coal-dust experiments; but it was very clearly brought out in the examination of the workings of Pochin Colliery, in Monmouthshire, after the great explosion in November 1884. The flame which in that case had all but filled the mine, and had penetrated into the remotest parts of three districts of workings ventilated by separate air-currents, was found to have been arrested by a slight dampness on one of the roadways leading to several working places. A cask conveying water from a dip place to a point more convenient to the pumps was hauled along this roadway four times every twenty-four hours, and it was stated by the manager of the colliery at the time that the dampness in question was due simply to accidental leakages from this cask and not to any intentional application of water for the purpose of laying the dust. At the inquest on Mardy explosion also, in January last, it was pointed out that a similar accidental or irregular system of watering appeared to have stopped the flame in four different directions, and to have saved the lives of many of the workmen (*Western Mail*, January 21, 1886).

Systematic watering with the avowed object of preventing the spread of explosions has hitherto been practised in very few collieries in this country. Llwynypia Colliery in the Rhondda Valley is a notable exception. Soon after the earliest coal-dust experiments had been made there in 1875 the intelligent proprietors and manager constructed a number of water-tanks on wheels, each provided with a perforated pipe at the back like an ordinary watering cart. Some of these were intended to be drawn by horses along the less frequented roadways, others to be attached to the trains of waggons which are drawn along the underground railways by means of wire ropes actuated by engine-power. The result of watering by this means was satisfactory and remarkable. The whole mine became cooler and more pleasant to live in. The dust, as such, disappeared not only from the floor of the roadways but also from the timbers and from the ledges formed by the irregular projections in the side-walls, and became consolidated into a firm, compact, and slightly humid mass under foot.

On their first arrival in this country in 1880, MM. Pernolet and Aguilon, who were sent by the Commission du Grisou to study the state of the English mines, expressed the opinion then generally held, that watering the floor of a dry mine would leave ample supplies of dust on the timbers and side-walls to carry on an explosion once begun. But after seeing the actual results in

Llwynypia Colliery with their own eyes they altered their views considerably, as will appear from the following extract from their Report, which describes this incident of their visit :—

"*Ainsi, à Llwynypia, où les chantiers se développent jusqu'à 1500 mètres du puits, et où l'extraction est de 550 tonnes par jour avec un seul poste, il suffit par jour de 5 wagons d'une capacité d'un demi-mètre cub., soit de 4500m. d'eau. Nous avons pu constater que les galeries étaient partout très propres et l'atmosphère très épurée, bien que cette mine passât auparavant pour une de celles où l'atmosphère était la plus chargée et le boisaie le plus recouvert de poussières.*"

About a year and a half ago the Home Office began unexpectedly to prosecute the managers of a few widely separated mines in different parts of the country for firing blasting shots while the men ordinarily employed were underground. The practice of blasting under these conditions had been going on unchallenged ever since the passing of the Coal Mines' Regulation Act, 1872, and it was with a feeling somewhat akin to consternation that the colliery owners viewed the new reading then for the first time seriously sought to be attached to part of one of the General Rules. The manager of the Standard Steam Coal Colliery in South Wales was selected out of hundreds of others in the same predicament, and a prosecution against him was begun. The colliery owners of the district rallied round the Monmouthshire and South Wales Collieries' Association, and undertook the defence. Happily, however, for the ends of justice, as well perhaps as for the cause of science, the case soon became involved in a whirlpool of legal formalities from which, as far as present appearances go, it is little likely to escape until after the passing of the new Mines' Bill.

During the earlier stages of this prosecution the representatives and advisers of the owners met the Inspector of Mines for the district (the late Mr. T. E. Wales) and asked him to represent to the Home Office that they were prepared immediately to submit to a new rule compelling them to water their mines systematically if the objectionable interpretation of the shot-firing rule were withdrawn. At the same time they expressed the opinion that the rule they were themselves proposing would afford a real protection to the lives of the miners, and that the one they desired to be superseded had been founded upon a misapprehension of the true causes of explosions. This intelligent proposal was, however, allowed to fall to the ground, and the Juggernaut of office rolled on its ponderous and relentless course.

Where simple tanks on wheels are difficult or expensive to manipulate, they may be advantageously replaced by a system of pipes bringing water from the surface, or from a reservoir at a convenient height in the shaft, and distributing it at different points of the workings, in the form of a fine spray. This arrangement has been successfully applied both at Llwynypia and Standard Collieries. At the latter colliery the pressure of water at the bottom of the shaft is regulated to fifty pounds on the square inch. The water pipes, which are one inch and a half in diameter, lie on the floor at one side of the roadway, or are supported on timber as the case may be. At distances of fifty yards apart upright branch pipes rise vertically from the main to a height of about four feet, each provided with a leaden plug with one minute hole. The jets of water are directed horizontally across the roadway, and the spray is carried along in the air-current, moistening the floor, more or less, all the way from one jet to the next. The cost of first establishment is stated to be about 5*l.* per hundred yards, and the cost of maintenance to be almost *nil*.

If the dew-point of the air entering a mine were by any simple means raised to the normal temperature of the strata in which the workings are situated, it is obvious that no system of watering would be necessary, and that any desirable degree of dampness could be maintained in the roadways. The only objection to this method is, that it would necessitate raising the general temperature of all dry mines.

A slight dampness, such as that which prevails in shallow mines at all times, is sufficient to lay the dust effectually; and it is highly probable that, so soon as anything approaching this condition is maintained also in deep mines, we shall have heard the very last of "Great Colliery Explosions."

W. GALLOWAY

* P. 287, "Exploitation et Réglementation des Mines à Grisou en Belgique, en Angleterre et en Allemagne." Rapport de Mission fait à la Commission chargée de l'étude des moyens propres à prévenir les explosions de grisou dans les Houillères, par MM. A. Pernolet et L. Aguilon, "Angleterre." Paris, 1881.