at the sea-level, a position favourable for air-, but not for sun-warmth. In our large towns, however, we artificially create an impenetrable barrier to solar radiation by throwing into the air the imperfectly burnt products of bituminous coal.

These products are of three kinds—soot, tar, and steam. Every ton of bituminous coal burnt in our grates gives off about 6 cwts. of volatile but condensable products. The less perfect the combustion the more tar and the less steam will be produced. If perfectly burnt without any smoke, then about 9 cwts. of steam, occupying 27,359 cubic feet at 100° C., or 20,024 cubic feet at 0° C. will be sent into the air. Now, 33,333 tons of bituminous coal are, on the average daily consumed in London in winter, giving 667,460,000 cubic feet of steam at 0° C.

This combustion of enormous quantities of bituminous coal acts in the production of town fog in three ways:—1st. By supplying the basis of all fog—condensed watery particles. 2nd. By determining the condensation of atmospheric moisture in the form of fog. 3rd. By coating the fog particles with tar, and thus making them more persistent.

All fogs have for their basis watery particles, and the greater part even of the suspended matters visible in a ray of electric light consists of these particles, for the air becomes nearly clear when it is heated somewhat above 100° C. [Experiment shown]. Everything therefore which increases the proportion of aqueous vapour in town air tends to produce fog. But aqueous vapour alone would probably never produce fog, for it condenses at once to large particles, which rapidly fall as rain. When, however, solid or liquid particles are present in the air, the minute spherules of fog are produced. This was first shown by Messrs. Coulier and Mascart, in 1875, and their results have since been confirmed by Mr. Aitkin. The speaker showed that air filtered through cotton wool, though afterwards saturated with moisture, produced no fog when its temperature was lowered; but as soon as a small quantity of the dusty air of the theatre was admitted fog was immediately formed, whilst, when a little coal smoke was introduced, a dense and more persistent fog was the result.

The fog once formed is rendered more persistent by the coating of tarry matter which it receives from the products of the imperfect combustion of smoky coal. The speaker had made numerous experiments on the retardation of evaporation by films of coal tar. He had found that the evaporation of water in a platinum dish placed in a strong draught of air was retarded in one experiment by 84 per cent. and in another by 78·6 per cent., when a thin film of coal tar was placed on the surfaces. Even by the mere blowing of coal smoke on the surface of the water for a few seconds, the evaporation was retarded by from 77·3 to 81·5 per cent. Drops of water suspended in loops of platinum wire were also found to have their evaporation retarded by coal smoke. Hence arise the so-called dry fogs which have been observed by Mr. Glaisher in balloon ascents, some examples of which are given in the following table:—

FOG IN COMPARATIVELY DRY AIR.

Place of Ascent.	Altitude.	Temperature of Air.	Degree of Humidity.
	Feet.	°F.	100 = saturation.
Wolverhampton	5,922	53·5	61
Crystal Palace...	3,698	38·5	62
,, ,, ...	9,000	32·5	52
,, ,, ...	1,000	64·7	53
Wolverton	11,000	30·0	68
Woolwich	6,000	44·0	64
,, ...	4,400	42·0	52

Thus the smoke of our domestic fires constitutes a potent cause both for the generation and the persistency of town fogs. In London, at all events, if all manufacturing operations were absolutely to cease, the fogs would not be perceptibly less dense or irritating. Granting then this cause of town fogs, what are the remedies open to us? The speaker was of opinion that the substitution of a sufficient number of smoke-consuming grates (assuming a smoke-consuming grate to have been invented), for the 1,800,000 fire-places of London was quite hopeless, and that one remedy only could be of any appreciable service—*the importation of bituminous coal must be forbidden.* This is a case in which individual effort can do nothing; but State or municipal action would be simple and decisive.

There need be no fear that the price of smokeless fuel would rise inordinately, for the sources of this fuel are too numerous and inexhaustible to admit of either a monopoly or a serious rise in price. In addition to the enormous stores of smokeless coal in the Welsh coal-fields, every bituminous coal yields a smokeless coke, either in the retorts of gasworks or in coke ovens. On the average, 100 tons of smoky coal yields 60 tons of coke, the remaining 40 tons being driven off as combustible gas, ammoniacal liquor and tar; and as there is an almost unlimited demand for these products, it is not unlikely that they would, under the circumstances contemplated, repay the cost of coking, and it is worthy of note that coal of very inferior quality makes fairly good coke.

The only objection to the domestic use of smokeless coal and coke is the difficulty of lighting the fire, but this is obviated by the use of gas as proposed by Dr. Siemens. In ordinary grates, however, there is little difficulty in lighting and burning these smokeless fuels if the throat of the chimney be contracted so as to increase the draught. In this way nearly every grate in London could be rendered smokeless at an expenditure of a couple of shillings.

It is unnecessary to enumerate the many advantages of a smokeless atmosphere, but it may here be mentioned that London fogs not only seriously injure health but annually destroy the lives of thousands. In one week alone upwards of 1,100 lives have been thus sacrificed in London. We have doubtless still long to wait before the only remedy for London fogs will be adopted; but in the meantime, immunity from their effects, so far as the respiratory organs are concerned, may be obtained by the use of a small and very portable cotton-wool respirator which is made, in accordance with the speaker's directions, by Mr. Casella, of Holborn. [Respirator exhibited.] Armed with this little instrument, he had often passed through the densest and most irritating fogs with perfect immunity, breathing, in fact, all the time, air even purer than that of the country. Such a remedy is, however, obviously of extremely limited application.

In conclusion he said, though we may, with justice, complain of the scanty share of sunshine now received by us, let us not forget that, in our coal-fields, we are compensated by vast stores of the sunlight of past ages. How far through electricity, these stores can be evoked to supplement the present defective supply, he would be a bold man who would venture to predict. Let us not, however, continue to use this great legacy of light of the past to obscure the small one of the present.

SCIENTIFIC SERIALS

American Journal of Science, July.—Contributions to meteorology (seventeenth paper), by E. Loomis.—The phenomena of metalliferous vein-formation now in progress at Sulphur Bank, California, by J. Le Conte and W. B. Rising.—Modes of occurrence of the diamond in Brazil, by O. A. Derby.—On the influence of time on the change in the resistance of the carbon-disc of Edison's tasimeter, by T. C. Mendenhall.—Further observations on the crystallised sands of the Potsdam sandstone of Wisconsin, by A. A. Young.—On the origin of jointed structure, by G. K. Gilbert.—Break-circuit arrangements for transmitting clock-beats, by F. E. Nipher.—Cirriped crustacean from the Devonian, by J. M. Clarke.

Archives des Sciences Physiques et Naturelles, No. 7, June 15.—Contribution of astronomy to the solution of a problem of molecular physics, by M. R. Pictet.—Study of the variations of kinetic energy of the solar system, by MM. Pictet and Cellerier. Swiss Committee of Geological Unification, by M. Renevier.—On a characteristic of the Batatas, whose singularity in the family of the Convolvulaceæ has not been sufficiently remarked, by M. de Candolle.—Observation of Mr. Meehan on the variability of the English oak (*Quercus robur*), and remark by M. de Candolle.—Note on Echinida gathered in the environs of Camerino (Tuscany), by M. Canavari.

No. 7, July 15.—On the rotatory polarisation of quartz, by MM. Soret and Sarasin.—On the diffusion of bacteria, by M. Schnetzler.—Petrogenic classification or grouping of rocks according to their mode of formation, adopted for academic instruction and for the museum of Lausanne, by M. Renevier.

SOCIETIES AND ACADEMIES

VIENNA

Imperial Academy of Sciences, July 13.—O. Tumlirz, on a method for researches on the absorption of light by