

for trapping soot in chimneys. A small trap of this kind was shown. It consisted of a tall metal tube or chimney, surrounded by another tube slightly larger. The products of combustion are taken up the centre tube and down the intervening space. The heat of the gases is thus made to do its own filtering. This apparatus being placed over a smoky lamp, it trapped out most of the soot, and deposited it on the inside of the outer tube. This arrangement of apparatus is too delicate and troublesome for general use, and it is suggested that, as by simply cooling gases in presence of plenty of surface much of its dust is deposited, it might be possible and advantageous under certain conditions to purify air by heating and cooling it a number of times, which could be done at a small expense by means of regenerators.

Experiments were also made by discharging electricity into the smoke in a chimney. This also produced a marked diminution in the blackness of the escaping smoke. The supply of electricity of sufficiently high potential is however a difficulty for the present.

### A VAST DUST ENVELOPE<sup>1</sup>

SCIENTIFIC men have evinced extraordinary interest in the wonderfully brilliant sunsets that have for some time past been observed in different parts of the world. Various theories have been advanced, but all are agreed that the real cause is not yet definitely determined. At the Brevoort House yesterday, a *Tribune* reporter spent a couple of hours with Prof. S. P. Langley, astronomer at Allegheny Observatory, Allegheny, Penn. His views upon the topic of the transmissibility of light through our atmosphere are stated below:

"At first I supposed the sunset matter a local phenomenon, but when the reports showed it to have been visible all over the world, it was obvious that we must look for some equally general cause. We know but two likely ones, and these have been already brought forward. One is the advent of an unusual amount of meteoric dust. While something over ten millions of meteorites are known to enter our atmosphere daily, which are dissipated in dust and vapour in the upper atmosphere, the total mass of these is small as compared with the bulk of the atmosphere itself, although absolutely large. It is difficult to state with precision what this amount is. But several lines of evidence lead us to think it is approximately not greatly less than 100 tons per diem, nor greatly more than 1,000 tons per diem. Taking the largest estimate as still below the truth, we must suppose an enormously greater accession than this to supply quantity sufficient to produce the phenomenon in question; and it is hardly possible to imagine such a meteoric inflow unaccompanied with visual phenomena in the form of 'shooting stars,' which would make its advent visible to all. Admitting, then, the possibility of meteoric influence, we must consider it to be nevertheless extremely improbable.

"There is another cause, which I understand has been suggested by Mr. Lockyer—though I have not seen his article—which seems to be more acceptable—that of volcanic dust; and in relation to this presence of dust in the entire atmosphere of the planet, I can offer some little personal experience. In 1878 I was on the upper slopes of Mount Etna, in the volcanic wastes, three or four hours' journey above the zone of fertile ground. I passed a portion of the winter at that elevation engaged in studying the transparency of the earth's atmosphere. I was much impressed by the fact that here, on a site where the air is supposed to be as clear as anywhere in the world, at this considerable altitude, and where we were surrounded by snow-fields and deserts of black lava, the telescope showed that the air was filled with minute dust particles, which evidently had no relation to the local surroundings, but apparently formed a portion of an envelope common to the whole earth. I was confirmed in this opinion by my recollection that Prof. Piazz Smyth, on the Peak of Teneriffe, in mid-ocean, saw these strata of dust rising to the height of over a mile, reaching out to the horizon in every direction, and so dense that they frequently hid a neighbouring island mountain, whose peak rose above them, as though out of an upper sea. In 1881 I was on Mount Whitney, in Southern California, the highest peak in the United States, unless some of the Alaskan mountains can rival it. I had gone there with

an expedition from the Allegheny Observatory, under the official direction of General Hazen, of the Signal Service, and had camped at an altitude of 12,000 feet, with a special object of studying analogous phenomena. On ascending the peak of Whitney, from an altitude of nearly 15,000 feet the eye looks to the east over one of the most barren regions in the world. Immediately at the foot of the mountain is the Inyo Desert, and on the east a range of mountains parallel to the Sierra Nevada, but only about 10,000 feet in height. From the valley the atmosphere had appeared beautifully clear. But from this aerial height we looked down on what seemed a kind of level dust-ocean, invisible from below, but whose depth was six or seven thousand feet, as the upper portion only of the opposite mountain range rose clearly out of it. The colour of the light reflected to us from this dust-ocean was clearly red, and it stretched as far as the eye could reach in every direction, although there was no special wind or local cause for it. It was evidently like the dust seen in mid-ocean from the Peak of Teneriffe—something present all the time, and a permanent ingredient in the earth's atmosphere.

"At our own great elevation the sky was of a remarkably deep violet, and it seemed at first as if no dust was present in this upper air, but in getting, just at noon, in the edge of the shadow of a range of cliffs which rose 1,200 feet above us, the sky immediately about the sun took on a whitish hue. On scrutinising this through the telescope it was found to be due to myriads of the minutest dust particles. I was here at a far greater height than the summit of Etna, with nothing around me except granite and snow-fields, and the presence of this dust in a comparatively calm air much impressed me. I mentioned it to Mr. Clarence King, then Director of the United States Geological Surveys, who was one of the first to ascend Mount Whitney, and he informed me that this upper dust was probably due to the 'loess' of China, having been borne across the Pacific and a quarter of the way around the world. We were at the summit of the continent, and the air which swept by us was unmingled with that of the lower regions of the earth's surface. Even at this great altitude the dust was perpetually present in the air, and I became confirmed in the opinion that there is a permanent dust shell inclosing the whole planet to a height certainly of about three miles (where direct observation has followed it), and not improbably to a height even greater; for we have no reason to suppose that the dust carried up from the earth's surface stops at the height to which we have ascended. The meteorites, which are consumed at an average height of twenty to forty miles, must add somewhat to this. Our observations with special apparatus on Mount Whitney went to show that the red rays are transmitted with greatest facility through our air and rendered it extremely probable that this has a very large share in the colours of a cloudless sky at sunset and sunrise, these colours depending largely upon the average size of the dust particles.

"It is especially worth notice that, as far as such observations go, we have no reason to doubt that the finer dust from the earth's surface is carried up to a surprising altitude. I speak here, not of the grosser dust particles, but of those which are so fine as to be individually invisible, except under favouring circumstances, and which are so minute that they might be an almost unlimited time in settling to the ground, even if the atmosphere were to become perfectly quiet. I have not at hand any data for estimating the amount of dust thrown into the air by such eruptions as those which recently occurred in Java and Alaska. But it is quite certain, if the accounts we have are not exaggerated, that the former alone must have been counted by millions of tons and must in all probability have exceeded in amount that contributed by meteorites during an entire year. Neither must it be supposed that this will at once sink to the surface again. Even the smoke of a conflagration so utterly insignificant, compared with nature's scale, as the burning of Chicago, was, according to Mr. Clarence King, perceived on the Pacific Coast; nor is there any improbability that I can see in supposing that the eruption at Krakatoa may have charged the atmosphere of the whole planet (or at least of a belt encircling it) for months with particles sufficiently large to scatter the rays of red light and partially absorb the others, and to produce the phenomenon that is now exciting so much public interest. We must not conclude that the cause of the phenomenon is certainly known. It is not. But I am inclined to think that there is not only no antecedent improbability that these volcanic eruptions on such an unprecedented scale are the cause, but that they are the most likely cause which we can assign."

<sup>1</sup> From the *New York Daily Tribune*, January 2. Communicated by Prof. Piazz Smyth.