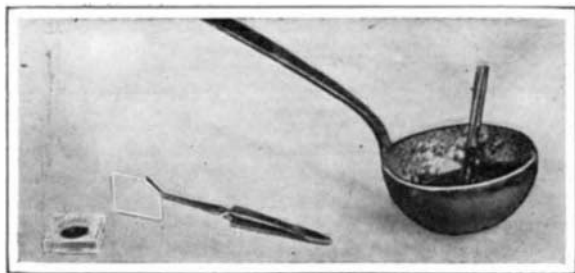


NOVEL METHODS OF DETERMINING THE AMOUNT OF ATMOSPHERIC DUST.

BY DR. ALFRED GRADENWITZ.

Many methods have been suggested to ascertain the amount of dust contained in air of large cities. The



Glass block with ground spherical segment containing a resin plate.

Pincers with covering glass.

Ladle for preparing resin (or varnish) and glass rod for transferring the resin to the glass plate.

Preparing the Dust-Collecting Plates.

best known of these consists in drawing a certain amount of air through a cotton or glass wool filter, and in weighing the filter before and after the operation. This, as well as many other processes identical in principle, are not of much value because of the great differences in the specific gravity of dust particles. Air containing little dust but including many mineral components or even dust from heavy metals might for instance result in an increased weight of the filter, whereas but a slight increase would result from the absorption of light organic matter. Moreover, it requires many hours to draw in an amount of dust susceptible of weighing.

In other processes the number of the dust particles is calculated, for which purpose an apparatus is employed by means of which the air is drawn against a plate lined with a moist substance, after which the adherent dust particles are counted by the aid of a microscope. Their number for each liter of air is ascertained from the averages found for a number of sections, multiplying the number of sections by the average and dividing by the number of liters of air which traverses the apparatus.

An interesting method invented by John Aitkens is based on the observation that water is separated as cloud from air saturated with steam only when dust particles are present.

An especially simple and practical method has been recently invented by Dr. Vörner, of Leipsic, and Prof. F. Hofmann. This method is also based on the

counting of dust particles. Weight is not considered.

In constructing his apparatus, Dr. Vörner availed himself of the fact that the dust deposited on polished black surfaces is easily seen. As neither polished ebony surfaces nor dark glass plates were available for his purposes, owing to the fissures revealed under the microscope, Dr. Vörner decided on preparing special plates to be used for the deposition of dust. After melting a blackened resinous substance, a certain amount of it was applied to a glass plate and allowed horizontally to solidify. On observation under the microscope, the fresh surface was seen to show an absolute uniformity and perfect polish. Though ordinary daylight was quite sufficient for an observation of these dark plates, there was the disadvantage of the inconsistency of illumination, the details being seen more distinctly in the case of illumination by sunlight than with dim daylight. Dr. Vörner therefore used an incandescent gas lamp placed at a certain distance from the microscope, the light being concentrated by a large convex lens, so as to have the focus fall on the surface of the dark plate. The distance of the lens from the microscope being kept constant, the surface illumination thus obtained showed a strictly constant intensity, the light striking the plate at an angle of about 37 deg.

If a fresh resinous surface be observed under the microscope, some strongly refracting points will be found to spring up gradually in ever-increasing numbers, these points being nothing else than dust particles coming down from the air. The whole plate thus assumes the appearance of a star-lit sky, the suddenly appearing particles reminding one of shooting stars. It may be remembered that the above outfit is quite similar to the *ultra-microscope* constructed by Siedentopf and Zsigmondi. Experiments showed the dust particles to be fixed in position by the resinous mass.

Now, in order to keep the resin plates free from dust up to the moment the experiment is started, Dr. Vörner placed a glass ring $\frac{3}{4}$ millimeter in height on the semi-liquid resinous mass, and on which was placed a watch glass freed from any dust by heat, the space between the glass ring and watch glass being filled with vaseline.

Before beginning an experiment, the watch glass is removed with a pincette and exposed for ten minutes, after which it is replaced in position, the resin plate observed under the microscope and the number of dust particles per square centimeter calculated.

According to a modified process, Dr. Vörner has tried to ascertain the amount of dust contained in each liter of air by the aid of airtight boxes lined with vaseline and kept closed for at least twenty-four hours, during which time the dust from the inclosed air is entirely fixed on the walls and at the bottom. When placing a newly-opened resin plate at the bottom of the box before the experiment is begun, the dust can be readily gaged under the microscope.

Dr. Vörner has used his process in extensive experiments, intended mainly to ascertain the percentage of dust in the air of dwelling rooms, on streets, public squares, in parks as well as in schools, auditories, gymnasiums, and the like.

Experiments on the composition of the air of Berlin streets have been recently carried out at several places where dust collectors more than 2 meters in height were installed. As no official data have so far been made public, we are unable to state what method has been used. Anyhow, these dust collectors were round sheet metal boxes more than 50 centimeters in height, the cover of which remained open and was allowed to receive the dust kept in suspension in the air. Some time afterward the sheet metal box was closed and taken to the chemists, who analyzed the dust contained in the collectors. It was intended by these observations mainly to ascertain what bacilli and what amounts of substances prejudicial to the organs of respiration are contained in the dust.

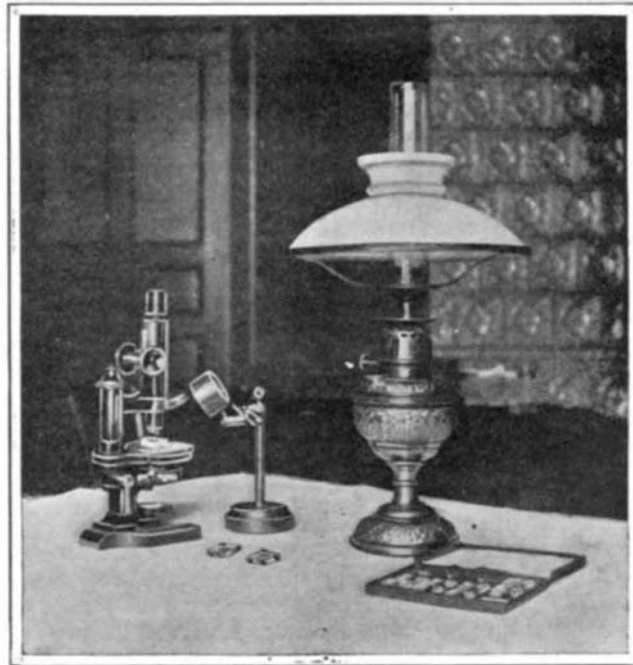
As, however, these experiments were soon abandoned, without any report being published, it would rather seem as though the apparatus was not efficient enough to warrant the anticipated results.

The writer is indebted for part of the above particulars to Dr. K. Stich, of Leipsic, who has carried out extensive experiments with the Vörner dust-gaging outfit, mostly in connection with a spraying apparatus constructed by himself for the laying of dust in large halls.

It is estimated that the annual consumption of coal in New York is fifteen and one-half million tons.

Lightning Stroke and Magnetism.

The recent researches made in Italy by G. Platania show the magnetizing effect of lightning discharges upon volcanic rock. M. Folgheraiter found that in the volcanic regions a certain number of highly magnetic points or areas could be located, and here the effects of lightning were also observed, so that the magnetizing effect seemed to be due to this cause. However, the same points had never been investigated both before and after the lightning stroke. The writer commenced researches upon the magnetism of rocks from the Etna, and tried whether the wall of a house which was built of blocks of basaltic lava and brick showed any magnetic effect, but this was too small to be appreciable. On the 20th of September last a severe storm caused the fusion of a telephone wire, leaving the earth wire which ran down along this wall intact,



Microscope with glass block. Condensing lens. Illuminating lamp. Box for transporting glass blocks.

The Experimental Outfit for Testing Street Dust.

and the lightning discharge must have passed down this wire. The next morning he found that the corresponding part of the wall showed a strong magnetic effect for a distance of 6 inches, having the north pole to the left. The discharge current must have thus been directed from the bottom to the top. During the same storm, lightning struck Sig. Frorini's residence, causing some damage. The lightning rods of copper are held on insulators about 6 inches from the wall. The house is a new one, and had never before received a lightning stroke. While the lava blocks forming the wall which lie far off show scarcely any magnetic effect, when we come near the lightning rod the action of the wall upon the needle is seen at 10 feet distance. It seems remarkable that such strong effects are produced by an insulated wire lying so far from the wall.

The Current Supplement.

The current SUPPLEMENT, No. 1570, opens with a continuation of our Paris Correspondent's observations on the Paris Automobile Show. One of the largest examples of the application of suction gas engines to the propulsion of boats for river navigation is furnished by the German vessel "Lotte." This craft, which is driven by producer-gas engines, is fully described and illustrated. Lieut. H. J. Jones's splendid monograph on armored concrete is continued. Dugald Clerk, one of the world's greatest gas engineers, discusses in a most lucid and authoritative manner the problem of the gas turbine. The human organism has often and aptly been compared with a fine piece of machinery. An excellent article graphically illustrates how true this simile is. Rear-Admiral George Melville, former Chief Engineer of the United States Navy, discusses liquid fuel for naval and marine purposes. The imitation of geological phenomena by means of various experimental arrangements is undoubtedly a great help to the teacher. How simple apparatus can be constructed which will excellently demonstrate the effects which have been produced by various geological causes is told in a well-illustrated and thorough article. Of interest to the naturalist are brief but instructive descriptions of the bee louse, and the habits and life history of a social spider.

The Award of the Fritz Medal.

The second award of the John Fritz medal has been made to George Westinghouse. This medal was established by the professional associates and friends of John Fritz, of Bethlehem, Penn., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress.



The Dust Collector Set up in a Prominent Square in Berlin.

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