Gory-Lindner elutriator, Cushman and Hubbard's air elutriator, the Petersen apparatus, the Griffin-Goreham standard flourometer, the Thompson classifier, Feret's air sifter, and Mackey's apparatus. Then the authors describe the new Bureau of Standards air analyzer, the essential features of which are as follows:—

The analyzer proper consists of a bulb with a set of three interchangeable nozzles, a stack or separating chamber, a tapper, electrically operated, and a dust collector, which retains all material carried off through the vertical separating chamber. The auxiliary apparatus consists of a motor-driven blower, and a grease-trap to prevent oil and grease from getting into the air tube leading to the reservoir. This auxiliary apparatus is designed entirely for the purpose of automatically supplying air at constant pressure to the analyzer. The complete equipment is shown in Fig. 1.

The process of making a separation with the analyzer is described as follows:—

The motor and blower are first started at slow speed, and the air tube leading from the reservoir to the analyzer is connected to the nozzle to be used. This causes a rise in pressure in the reservoir, indicated on the gauge, which is to be raised to the working pressure of 1 pound per square inch. The pressure is further raised by gradually closing the blow-off, and if not high enough when the latter is completely closed, the blower speed is increased. It is desirable always to have an excess of air supplied by the blower, and to have the blow-off so adjusted as to allow a slightly greater quantity of air to pass into the reservoir than is required for the analyzer. Further regulation of pressure is automatically provided by the regulator, which consists of a vertical pipe about 5 ft. long and 4 in. in diam., closed at the bottom and nearly filled with kerosene. Into this a long glass tube connected to the reservoir and open at the lower end projects to a depth which can be adjusted and is approximately the same as the difference in level of the kerosene in the two arms of the gauge at working pressure. This adjustment is always made by trial, and when the proper depth is attained, the regulator functions perfectly for an indefinite time without further attention.

It is obvious that if the pressure in the reservoir is below the required working pressure, air can escape from the reservoir only through the analyzer nozzle, but by further closing the blow-off, the pressure rises and the kerosene is driven down the regulator tube until finally the seal is broken and air bubbles off. The pressure in the reservoir will thereafter remain sensibly constant, unless the speed of the blower varies considerably. In normal operation, therefore, the oil in the pressure gauge mounts quickly to its prescribed height and remains there while the regulator disposes of the slight excess of air supplied to the reservoir. Unavoidable irregularities in the speed of the blower are thus automatically compensated and the gauge indicates the constant pressure of the air supplied to the nozzle. Variations in the reservoir pressure as large as 1 per cent. are rare, and of this magnitude are entirely negligible in their effect on the separations.

Having adjusted the blow-off, the nozzle is removed from the air tube and inserted in the bulb, which is detached from the stack. The weight of nozzle and bulb should be known to the nearest 0.01 g. If the 0.001-inch separation is to be made, a 33⅓ g. sample of cement is placed in the bulb; if the coarser separations are desired, 50 g. are ordinarily used. The bulb containing the cement is then attached to the stack, the air tube is connected to the nozzle, the tapper is started, and the analysis proceeds without further attention on the part of the operator. The residue in the bulb gradually darkens as the fine material is removed, and in the course of half an hour or less appears to become distinctly granular, especially in the coarser separations. It has been found by experiment that greater uniformity in the fractions is obtained if the separations are regarded as completed when a certain rate of loss is reached, as in the case of the No. 200 sieve fineness determination. The air separations require a considerably longer time, however, as the diminuation of the quantity of material removed is much less rapid toward the end of the process than in the sieve separations.

One of the practical uses of the analyzer is its adaptation to the study of the products of different types of grinding machinery. Comparative examinations of this sort can be made without calibration of the analyzer, and from examination of a large number of cements a fairly correct notion may be obtained of the characteristics of different mills. For the most reliable comparisons, however, the tests should be made on cements ground from the same clinker. Similarly, the degree of pulverization of different clinkers in a given mill can be determined, and the effects of hardness and other variables can be studied with the aid of the analyzer more satisfactorily than with the aid of sieves alone.

Experience has shown that the analyzer is equally well adapted to separations of other materials than cement, and in many cases may give more consistent results on other materials. For example, excellent separations have been made of ground quartz, emery, alumina, and other hard-grained materials. A new field of usefulness has recently been found in the testing of molding sands, in which the ordinary clay and silt determinations are especially important, but ordinarily made by crude washing and settling methods. On the other hand, the present form of analyzer has failed in attempts to separate hydrated lime and certain paint pigments, in which the coarse material appears to consist of compact agglomerates of fine particles, or of soft grains.

NIAGARA FALLS PARK ROADWAYS.

Last year the roadways of the Queen Victoria Niagara Falls Park were treated with heavy asphaltic material applied hot and under pressure, after which a liberal covering of pea stone was placed. According to the latest annual report of John H. Jackson, park superintendent, this carpet treatment has provided an excellent wearing surface impervious to water and capable of taking the wear which would otherwise come upon the road metal itself. It is found that prompt attention to small depressions and ruts proves more economical than allowing the roadway to deteriorate to such a degree that large resurfacing operations have to be undertaken to restore it.

The percentage of all-steel passenger cars built in the United States during the past six years has increased from 26 to 74.6, while the percentage of steel underframe cars built has increased from 14.8 to 20.9. The older wooden cars are being steadily withdrawn from service, so that the percentage of steel and steel underframe cars will increase rapidly within the next few years. Wooden cars to the number of 1,048 were withdrawn during the calendar year 1914. It is estimated that to replace the present wooden cars will cost approximately $560,000,000.