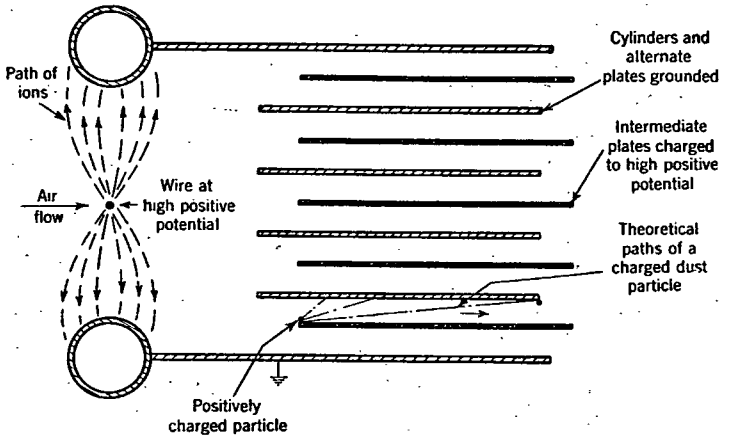

FIG. 1. DIAGRAMMATIC CROSS-SECTION OF ELECTROSTATIC PRECIPITATOR

have been constructed. The media are supported on rollers and move slowly and continuously across the air stream and then through some cleaning mechanism, such as a beater, a vacuum cleaner, or a brushing arrangement. Such filters, however, are not now in wide use, possibly because of mechanical difficulties and the rapid and sometimes permanent increase of resistance caused by oily matter present in the air.

The medium in a typical automatic filter at present consists of a series of specially formed metal plates mounted on a pair of chains. The chains are mounted on sprockets located at the top and bottom of the filter housing, so that the filter medium can be moved as a continuous curtain up one side and down the other side of the sprockets. The arrangement is such that, at the bottom, the medium passes through a bath of special oil which both serves to remove the dirt from the plates and acts as an adhesive when the cleaned plates next pass through the air stream. The plates forming the filtering medium or curtain usually overlap each other and due to their special shape many small air passages are formed between them. These air passages turn abruptly one or more times in order to give the impingement effect.

An electrically driven rotating device is usually supplied with an automatic filter. The device may be set to move the curtain periodically, or a special switch, actuated by pressure drop, may be used to govern its motion. Such a switch will cause the gear to move the curtain when the resistance of the filter to air flow becomes excessive and will stop it when the resistance becomes sufficiently low.

In operation, the resistance of an automatic filter will remain approximately constant as long as proper operation is obtained. A resistance of $\frac{3}{8}$ in. water at a face velocity of 500 fpm is typical of this class.

DRY AIR FILTERS

As the name implies, adhesives are not used on dry air filters. The media in such filters are usually fabrics or fabric-like materials. Media of wool felt, cotton batting (both glazed and unglazed), cellulose fiber and other materials have been used commercially. The medium in a filter of

this class is usually supported by a wire frame in the form of pockets or V-shaped pleats in order to increase the area exposed to the passage of air. A 2 ft square unit may contain from 15 to 30 sq ft of medium.

Dry air filters are likely to have a comparatively high lint-holding capacity on account of the large area of medium used. Wool felt media are troublesome to clean when impregnated with greasy dust and they are too expensive to discard frequently. Both vacuum cleaning and dry cleaning have been used for reconditioning wool felt filters.

ELECTRIC PRECIPITATORS

The fact that a particle exposed to an electric field will assume a charge and migrate toward one of the electrodes has been utilized for some years in boiler plants as a means of smoke abatement. The same principle has been used in equipment developed for air cleaning in air conditioning without generating ozone in intolerable quantities. The air stream in a precipitator passes first through a relatively high-tension electric field, known as the ionizing field, and then through a secondary field where the precipitation of the dust occurs. The arrangement is as shown in Fig. 1.

In a typical case, a potential of 12,000 volts may be used to create the ionizing field, and some 5000 volts between the plates upon which the precipitation of dust occurs. These voltages, which are capable of shock to personnel similar to that of a spark plug, necessitate some safety measures. A typical arrangement provides means for automatically making the unit inoperative when a door to the precipitator is opened. To resume operation the procedure necessitates closing the door and turning an electric switch, the latter of which should be located at a reasonable distance from the equipment. The voltages necessary for the operation of the precipitator are usually obtained from an alternating current building service line by means of a step-up transformer. Precipitation with alternating current is possible but is not nearly so effective; so the current is usually rectified by means of vacuum tubes. The transformer and tubes are collectively termed the power pack.

Only a very small amount of electric energy is necessary to operate an electric precipitator and the resistance to air flow through the device is practically negligible. Some care is necessary in arranging the duct approaches on the entering and leaving sides of precipitators to assure that the air flow is distributed uniformly over the cross-sectional area. The efficiency of the precipitator is sensitive to air velocity and the device itself has much less tendency to rectify the air stream than filters, which have much higher resistances.

Electric precipitators are available in both automatic and non-automatic types. The plates of non-automatic precipitators are commonly coated with a light oil as an adhesive. Cleaning is accomplished with a water hose and, for this reason, the bottom of the equipment is made water tight and provided with a drain. In one automatic type, precipitation units are mounted on chains and are alternately dipped in oil and exposed to the air stream with an action similar to that of an automatic impingement filter. An arrangement of sliding contacts maintains the necessary electric circuits.

PERFORMANCE AND TESTING

The rating of an air cleaner is the air flow for which it is designed expressed in cubic feet per minute. Face velocity is defined as the average