2. Degree of cleaning required.
3. Conditions of air or gas stream with reference to temperature, moisture content, and chemical composition.
4. Characteristics of the contaminant, corrosiveness, solubility, adhesion, or packing, and its specific gravity, surface, and shape.
5. Methods of disposal or salvage that meet the conditions imposed by material, process, or plant location.

In view of the range of these variables, all available test data, application experience, and manufacturers' performance data should be considered.

TYPES AND APPLICATION

There are a number of principles involved in the operation of industrial air and gas cleaners. They are illustrated by the following types of cleaners:

1. *Inertial Separators* (Gravitational or inertial force principle): Baffle Chambers, Centrifugal Collectors.
2. *Scrubbers and other Wet Collectors:* Air Washers, Wet Filters or Packed Towers, Spray Towers, Centrifugal or Inertial Scrubbers, Venturi Scrubbers.
3. *Filters:* Fabric Filters, Ultra or Absolute Filters.
4. *Electrostatic Precipitators.*
5. *Adsorbers, Absorbers, and Combustion Devices.*

Units employing these principles may apply them singly or in combination. The important characteristics of any unit are: its collection efficiency, resistance to air or gas flow (power requirements), ability to maintain specified air or gas flow during its operating cycle, and maintenance requirements.

In relation to industrial air cleaners, efficiency of collection is generally presented on a basis of weight removal. In many instances, collection efficiency is expressed in terms of weight removal in specific particle size ranges. Occasionally efficiencies are given in terms of visibility or photometric evaluation. Under other circumstances efficiencies are stated by particle count. For most process recovery problems and air pollution control, the weight basis has been adequate. When loss of visibility is the major problem, light opacity measurements may be required.

From a hygienic viewpoint where air is to be recirculated, only the contaminant concentration in the recirculated air stream, rather than the correction efficiency, should be considered.

Correlation between the various efficiencies is poor due to the wide variation in particle size, size distribution, and shape.

Resistance or pressure drop through any given collector is related to the operating principle, and varies about as follows: low resistance collectors—up to 2 in. water; medium resistance collectors—2 to 8 in. water; high resistance collectors—8 to 25 in. water.

In mechanical centrifugal collectors of the wet or dry type (power driven impellers or rotors) resistance alone is not of significance since these devices are also air movers and therefore the factor of paramount importance is the overall power consumption of the unit. This is also true of certain types of wet collectors which require auxiliary pumping power.

The ability of any unit to maintain specified air or gas flow during its operating cycle is also a function of its operating principle. For example,

inertial collectors of the simple and centrifugal type are able to maintain constant resistance regardless of concentration and particle size. However, adhesive materials may collect at the entry, throughout the unit, and at the exit, and thus cause a reduction in air flow and serious maintenance problems. With the exception of packed towers and wet filters, wet collectors operate at constant resistance throughout their operating cycles. However they may also be adversely affected by adhesive or corrosive materials. Wet filters or packed towers will eventually become clogged because of retention of inert dusts. Units employing fabric or other filter media will have resistance influenced by the concentration, particle size, shape and packing characteristics of the aerosol. Their overall resistance during the operating cycle may increase gradually over a known or determined period. Auxiliary cleaning devices such as separate compartments, alternately shaken, reverse air flow, or reverse jet air flow may maintain constant or nearly constant resistance or insure only small fluctuations in air or gas flow. Electrostatic precipitators have the outstanding characteristic of maintaining a constant air flow with an accompanying low resistance. Adsorbers behave similarly to packed towers in that they provide constant resistance until the voids become seriously plugged with inert dusts. This generally requires a matter of several months on normal applications.

It has been found that inertial separators require the least maintenance. Simple wet collectors rank next in this respect. Complex wet collectors and fabric arrestors require maintenance on a definitely scheduled basis. Electrostatic precipitators require the usual maintenance connected with high voltage equipment and may vary widely. The maintenance of adsorber type units is minimal and is based primarily on the amount of inert material encountered.

INERTIAL SEPARATORS

There are many types in this group. These range from simple settling chambers utilizing gravitational forces, to complex centrifugal devices using abrupt directional changes or motor driven rotors. They all have the desirable features of constant resistance during their operating cycle and do not require any special construction for temperatures under 750 F. Usually they require less maintenance than other types of collectors.

On the basis of their important characteristics inertial separators may be classified according to Table 1.

SCRUBBERS AND OTHER WET COLLECTORS

In these collectors many methods are used to wet the contaminant and remove it from the air stream. A number of wet collectors are similar in design to dry collectors with the addition of sprays or liquid contactors. The mechanism of separation in wet collectors depends on inertial forces such as impaction and impingement, and in some cases, diffusion.

Wet collectors do not require any special construction for high temperatures. They are suitable for use on mixed contaminants such as gases and solid or liquid particles. The collection of dust in a wetted form eliminates a secondary dust problem in disposal of collected material. Protection against corrosion and freezing may be necessary and disposal of waste liquids may become a problem. With the exception of the packed