

which appear to have possibilities for cases where the air to be cleaned is extremely dirty or where a higher degree of cleanliness is desired than can be obtained with an air washer. Information on air washers will be found in Chapter 12.

VISCOUS TYPE FILTERS

The principle of air cleaning used in viscous filters is that of *adhesive impingement*. Dust and dirt in the air, especially soot and carbons, are trapped and retained by successive impingements on coated surfaces. While the arrangements of filtering media and the kind of materials used are almost unlimited, there are certain rather definite requirements for a practical commercial filter.

Investigations in this country and abroad demonstrate that the first impingement of dust laden air on a viscous coated surface removes about 60 per cent of the dust, the next impingement takes 60 per cent of what then remains—that is, 24 per cent—and the next impingement removes 9.6 per cent. To secure maximum efficiency, it is necessary to divide the air into innumerable fine streams, as the more intimately and freely the air is brought into contact with the viscous-coated media the better will be the cleaning.

The binding liquid used with viscous filters should have the following properties:

1. Its surface tension should be such as to produce a homogeneous film-like coating on the filter medium.
2. The viscosity should vary only slightly with normal changes of temperature.
3. It should be germicidal in its action to prevent the development of mold spores and bacteria on the filter media.
4. The liquid should have a high affinity for dust at low temperatures.
5. The liquid should have high capilarity, or ability to wet and retain the dust.
6. Evaporation should not exceed 1 per cent.
7. It should be fireproof.
8. It should be odorless.

Viscous Unit Filters

In the unit type viscous filter, the filtering media are arranged in units of convenient size to facilitate installation, maintenance, and cleaning. Each unit consists of an interchangeable cell or replaceable filter pad and a substantial frame which may be bolted to the frames of other like units to form a partition between the source of dusty air and the fan inlet. Where necessary reconditioning equipment should be installed near each group of unit filters, with hot water and sewer connections provided.

To secure greater dust holding capacity and a practically constant resistance and air volume, the filter media are usually placed in the direction of air flow, with progressively finer filter densities determined by the percentage of dust impinged. This arrangement provides relatively large spaces for the collection of dirt in the front of the filter where the bulk of the dust is taken out without undue increase in resistance, while at the back of the filter the openings are smaller to secure high efficiency in the removal of the finer dust particles.

The resistance of a well-designed unit filter of the adhesive impinge-

ment type usually depends upon the velocity at which the air is handled and upon whether the unit is clean or dirty. The cleaning efficiency of the unit is usually highest after it has accumulated a certain portion of its maximum load of dirt because some dust collected in the cell acts as an efficient medium for the further seizing of solids from the air. By periodically cleaning a predetermined number of cells, the resistance and capacity of a built-up filter may be held at any desired figure. The frequency of cleaning any unit filter installation depends upon the dust concentration

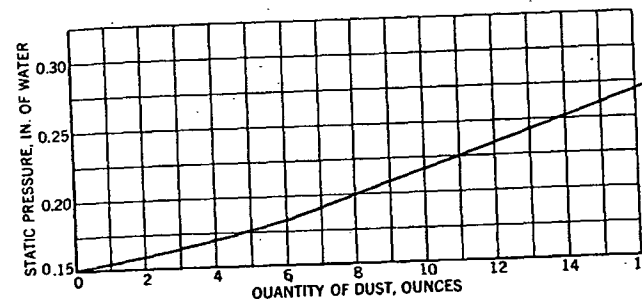


FIG. 2. CHART SHOWING CHANGE IN RESISTANCE DUE TO DUST ACCUMULATION

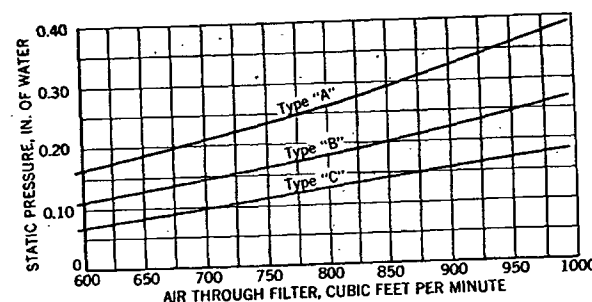


FIG. 3. RESISTANCE TO AIR-FLOW OF TYPICAL UNIT AIR FILTERS

of air being cleaned, and on the amount of dirt which can be accumulated in the filter medium without causing excessive resistance. (Figs. 2, 3 and 4.)

It is difficult to satisfactorily compare the cleaning efficiencies of various filter types unless the efficiency ratings are determined under laboratory conditions in accordance with some definite test procedure such as that developed by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS². Efficiency tests made in the field with *atmospheric dust* are subject to so many variables that consistent comparisons are difficult. Of course there is no *standard atmospheric dust*, as atmospheric dust varies widely in composition and concentrations in different localities. Wide variations are also found due to different seasons of the year as well as

²Loc. Cit. Note 1.