volumes of air at high velocities should be provided to give the occupants the benefit of the maximum air flow.[10]

c. Mechanical Cooling. When mechanical cooling is used to cool a space the air-distribution system should be such that the maximum amount of diffusion is provided at the discharge registers. This causes the cold air supplied to be thoroughly mixed with the room air for maximum cooling of the space with minimum objectionable drafts being felt by the occupants. The lower the ceiling the more important is the diffusion. There are many companies manufacturing special grilles for this purpose, most of which have a high entrainment ratio, which makes them quite suitable. Where low ceilings are involved systems in which a plenum chamber is provided above the ceiling proper so that the air enters the room through small perforations in the ceiling are increasingly popular. When properly installed these work very satisfactorily.

In plants with high ceilings the effectiveness and economy of the system can be improved by properly delivering the air close to the occupied space, as where air motion only is used for removing heat (page 227).

In general, it must be remembered that at all times the main objective is to cool the occupant. It cannot be determined whether air motion or diffusion is needed from the outlet until the method of cooling the man is decided. Every effort should be made to design and install a system that will give the maximum benefit throughout the entire year.

[10] K. E. Robinson, *Plant Engineering*, **11**, 86 (February, 1957).

CHAPTER IX

Air Cleaning

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This chapter deals with the principles of air cleaning and the problems of selecting effective equipment for controlling the quality of air in the industrial environment.

I. Applications of Air Cleaning

Two groups of applications are considered: (*1*) cleaning of air to make it acceptable for supply to indoor areas, and (*2*) cleaning of waste air or gas before discharge to the outer atmosphere, to avoid air pollution. Certain methods of air cleaning occupy a borderline position, suitable for both air conditioning and air-pollution control.

A. AIR-CONDITIONING APPLICATIONS

Air-cleaning equipment may be included in air-conditioning or ventilating systems for practically any confined space, whether stationary or moving: buildings, underground shelters,[1] protective enclosures (such as "iron lungs"), elevators, automobiles, buses, railroad cars, ships, submarines, and aircraft.

In these applications, air must be delivered in respirable condition, which means the proper oxygen content as well as a minimum of impurities. In addition, it may be necessary to produce air of sufficiently high quality to protect furnishings, manufacturing equipment, and products, such as biologicals, optical goods, or precision instruments.

Indoor air may be recirculated to conserve energy, or contaminated outdoor air may be treated to make it acceptable for indoor use.

1. Recirculation Air Cleaners

The advantages and necessities of recirculating air in commercial and residential air conditioning are well established. The trend toward more complete control of the atmosphere in manufacturing establishments for comfort, health, safety, product quality control, and equipment preservation has forced the designer to consider recirculation where never before attempted.

[1] W. Vessman, *Heating, Piping, Air Conditioning*, **26**, 122–127 (November, 1954), 84–88 (December, 1954).