

nected with central water-cooling equipment located remotely, and so may be used for dehumidifying and for air cooling. (See Chapter 9).

Direct fired unit systems of ventilation are used in industrial work, comprising warm-air furnaces with fans and motors.

All supply systems of ventilation may take air from out-of-doors, or may recirculate all or a portion of the air. Any of them may operate in connection with gravity outlets or in connection with mechanically induced outlets. For the purposes of this chapter, mechanically induced exhaust ventilation will be called exhaust ventilation.

Exhaust Systems

Exhaust systems of mechanical ventilation may be used in connection with any system of air supply. They will always be more effective if used to supplement controlled equipment for replacing with new air the exhausted air and its objectionable tenantry of gas or dust. Great skill may be used to advantage in the design of exhaust systems, and co-operation is required in most cases by the designer of the building itself. For instance, if an exhaust ventilating system is installed in a hotel kitchen which has many windows on three outside exposures, the inevitable opening of these windows by employees, plus the effect of wind pressure, will make the successful operation of such a system very difficult.

The outlets from the building for discharged air from exhaust systems of ventilation must be given careful attention. No dependence can be placed upon outlets which look out horizontally even though they come from powerful fans, as previously stated. A cold gale of wind against such an outlet can stop the egress of the objectionable gases. The exhaust fan outlet should look up and it must be far enough away from the windows of higher buildings and from the air supply inlets to ventilating systems that no cross-contamination may occur.

DISTRIBUTION OF VENTILATION

Distribution of the air used for ventilation to remove the aerial envelope of the bodies of the people is probably the most important function of a satisfactory ventilating system. There is no particular rule for locating inlets or outlets which can be laid down without also stating exceptions to the rule. The effectiveness of the distribution of air supply or exhaust is influenced profoundly by the temperatures of the walls and glass, and the heaters, lights and bodies of the people who occupy the room.

Inlets and Outlets in Schoolrooms

A very successful experimental school classroom ventilating scheme used a 3-in. diameter inlet under the book-shelf in each desk. Other favorable and satisfactory inlet locations, are:

1. Slots in the floor under radiators.
2. Grilles looking down through the ceiling.
3. Grilles looking up in the window stools.
4. Grilles looking up, as with schoolroom unit ventilating machines.
5. Horizontally discharging diffusers on the side of the room looking toward the windows.

It is reasonably safe to suggest that with the fifth type of inlet, several openings, symmetrically located, are better than a single unsymmetrical opening. Outlets from schoolrooms usually are on the sides of the rooms opposite the major glass exposure or are in the inner ends of the cloakrooms when the cloakrooms do not have any doors to separate them from the classrooms. Schoolroom ventilation exhaust openings are close to the floor.

Inlets and Outlets for Theaters, Auditoriums, Etc.

Successful plants are in operation using the upward system of air circulation from hooded openings in the floor under each seat, but there is less complaint and probably less danger of trouble from drafts in most auditoriums if the downward system of air circulation is used. Unless the ceiling of the room is very lofty, however, the downward-going air must be diverted and baffled horizontally so as to mix with the air already collected in the neighborhood of the inlet, or there will be complaint of drafts whenever air even slightly cooler than that already in the room is admitted. With comparatively low ceilings it is possible to use very satisfactorily these inverted diffusers with their somewhat high-speed horizontally-discharging air currents.

Inlets and Outlets for Industrial Service

In many cases it is desirable to use high velocity outlets from supply ducts, arranged so that they act like inspirators, the jets tending to draw large volumes of the surrounding, otherwise stagnant, air along with them.

In other cases drop-pipes from overhead ducts may have chain-suspended baffle plates across the bottom which may be adjusted to divert the major part of the air in any desired direction at any desired velocity.

Inlets and Outlets in General

When there is no heat loss from the room being ventilated, the entering air for ventilating purposes may be at very nearly the same temperature as the air in the room, and the air may be moved across the room, and the inlets and outlets may be opposite each other. They may be successful if calling for air circulation from floor to ceiling, or from ceiling to floor.

When, however, windows and cold walls and radiators must interpose their disturbing influence, or when there are gases or fumes or excess heat in great quantities, or when the entering air is cooler than the air in the room, complications are bound to occur, and in general the cooled air in the room or the cool entering air will fall to the floor, while the lighter heated air will rise to the ceiling. Therefore, in many cases both inlets and outlets, well designed, may be placed at the ceiling, the entering cool air being diffused and warmed somewhat as it falls slowly toward the floor, while the overheated air is skimmed off the top.

DESIGNING THE VENTILATING SYSTEM

After the heating and ventilation requirements have been calculated, the size of the heater and fan may be calculated for a given friction, tem-