OUTLET LOCATIONS

In selecting the location of outlets, consideration must be given to the factors of physical construction, physical appearance, location of heating or cooling loads, and outlet performance. Final outlet location will be a compromise between these factors.

1. The *physical construction* of a building, particularly of old buildings, immediately places limitations on the type of distribution system which can be employed. Therefore, the first factor in the selection of outlet locations is a consideration of the possible location of the supply duct, that is, whether it is above the ceiling, within the walls, through furred spaces above corridors, or in the conditioned space, etc. A particular method of distribution may be highly desirable but its execution, due to the location of beams and masonry walls, may be an impossibility.

2. The *physical appearance* of the outlets should conform to the esthetic appearance of the room. In factories, warehouses, etc., the esthetic demand may not be high; however, in department stores, clubs, theaters, etc., the location of the grilles may be entirely dictated by such demands. In carefully decorated rooms, it may even be necessary to completely conceal the method of distribution by the use of slots located in recesses in the walls or ceilings.

3. The location of *heating or cooling loads* in a room dictate to a great extent the general location of the outlets. The outlets should be located to neutralize any undesirable cold drafts or radiation effects set up by a concentration of the heating or cooling load. The problem can be divided into natural loads due to outside weather and internal heat loads.

Natural Heating or Cooling Loads

Winter. In winter the primary heating load is from exposed walls, windows and skylights. Heat is lost primarily through convection to these exposed surfaces. The convection currents or cold drafts drop down the exposed surfaces and seriously impair the comfort conditions in the room, and particularly at the floor level near the exposed surfaces. The outlet should be located to counteract these down drafts. Two methods may be employed:

1. Direct counteraction of the convection current can be accomplished by locating the outlets beneath windows or exposed walls and blowing upward or on the wall blowing across the exposed wall. This method is desirable in small offices or bedrooms, or any location where people are seated or working near exposed surfaces. In northern climates, where the outside temperature may be constantly below 40 F, and the construction consists of uninsulated walls and single glass this method of distribution is particularly useful for the maintenance of comfort requirements.

2. High induction by ceiling or wall outlets may be employed to nullify the convection currents from exposed surfaces. If outside temperatures are consistently below 40 F, and the exposed surfaces are poorly insulated, the induction effect required for neutralization of the down drafts is so great that the air motion in the room will exceed comfort limits. Therefore, in northern latitudes, this method can only be recommended for use in factories, warehouses, etc., where comfort conditions are not critical. The wide use of ceiling suspended heat diffusers in cold climates and in factory spaces illustrates the results to be obtained by such distribution. If the exposed walls are well insulated or the windows are equipped with double glass, ceiling distribution may prove reasonably satisfactory even in the coldest of climates. In mild climates, where the outside temperature seldom drops below 40 F, offices and bedrooms may be satisfactorily heated by ceiling or wall outlets.

Summer. The primary discomforting effect to be experienced in summer is the radiation from sun exposed walls or windows. Radiation from a wall is a function of the surface temperature of the wall which is related to the amount of wall insulation. Radiation from well insulated

walls is negligible compared to that from uninsulated walls. Radiation may be countered by blowing the air supply from an inner wall towards the exposed surface, or by discharging the air vertically upward along the exposed surface. If vertical distribution is employed, the outlet air should be fanned out at an angle of 15 to 20 deg with the vertical and in a plane parallel to the wall. Directing the air parallel to the wall minimizes the formation of a cold spot directly in front of the outlet when low velocities are used.

Internal Heat Load

If a concentrated source of heat is located at the occupancy level of the room, the heating or radiation effect may be countered by blowing the supply air toward the heat source or by locating an exhaust or return grille adjacent to the heat source. The latter method will prove more economical, as heat will be withdrawn at its source rather than be dissipated into the conditioned space. Where a lighting load is particularly

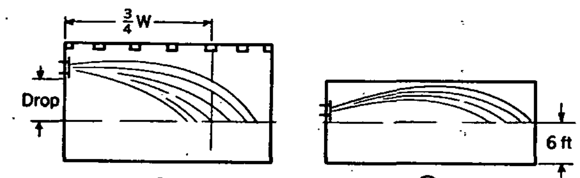

Fig. 6. Blow of Wall Outlets

heavy (five watts per square foot), and located high in a conditioned space, it may be economically desirable to locate the outlets below the lighting load. Warm air from the lights will stratify near the ceiling and can be removed by an exhaust fan.

Outlet Performance

The factors of outlet performance, throw, drop, capacity, noise, dirt and room air motion place considerable limitations on the design of a satisfactory distribution system.

1. *Blow.* The blow of wall or ceiling outlets should be selected to cover three-quarters of the distance toward an exposed wall or window as shown in *A* of Fig. 6. Overblowing is considerably more serious than underblowing, as an overblow will create objectionable down drafts from any surface it strikes; although underblowing in the case of heated air may be serious in that the warm air may rise too rapidly and thus cause stratification in the occupied zone. In spaces with beamed ceilings, the outlets should be located below the bottom of the lowest beam level, and preferably low enough so that an upward or arched blow may be employed. The blow should be arched sufficiently to miss the beams and, at the same time, in such a manner as to prevent the primary or induced air stream from striking furniture and obstacles producing objectionable drafts. If an outlet is adjusted downward to avoid a beam, cold air may enter the zone of occupancy long before the desired induction has taken place, thus causing serious complaints.

2. *Drop.* The outlets should be located so that the air stream at the termination of the blow is not less than 5 or 6 ft above the floor level. As illustrated in *B* of Fig. 6 the maximum permissible blow for a given ceiling height may be obtained by locating the outlet low on the wall, arching the blow, and sweeping the air across the flat ceiling. The air, as it traverses the room, will adhere to the ceiling. The objection to this method is the possible streaking of the ceiling with dirt.