sufficient length to establish surface effect. Under these conditions, air will travel along the ceiling to the end of the throw. If the slot diffuser is mounted 1–2 ft below the ceiling, an outlet which deflects the air up to the ceiling must be used, and will then achieve the same result. If the slot is located more than 2 ft below the ceiling, premature drop into the occupied zone of cold air will probably be the result.

Ceiling Installation. The perpendicular-flow slot diffuser should not, in general, be mounted on the ceiling. In this case, the discharge pattern is directed downward into the occupied zone and causes localized areas of high air motion affecting human comfort. Outlets of this type are sometimes located in the ceiling at the perimeter of the building, with air discharge towards the floor along the perimeter wall. This is a highly undesirable method, because it results in relatively high velocities on the floor near the wall.

The parallel-flow slot diffuser is ideally suited to ceiling installation. Its discharge pattern is across the ceiling.

Sill Installation. The perpendicular-flow slot diffuser is well suited to sill installation; but the diffuser may also be installed in the curb and floor. When the diffuser is located within 8 in. of the perimeter wall, the discharged air may be directed straight towards the ceiling, or it may be deflected slightly towards the wall. When the diffuser distance from the wall is greater than 8 in., the air should generally be deflected towards the wall at an angle of approximately 15 deg. In some cases, deflections as great as 30 deg towards the wall may be desirable. The air should never be deflected away from the wall into the occupied zone. The resulting air motion in the occupied zone will cause discomfort to the occupants.

To perform satisfactorily, outlets of this type must only be used in installations with carefully designed duct and plenum systems. (Refer to section Discharge from a Long Slot in Chapter 29.)

Slot diffusers are generally equipped with accessory devices for uniform discharge of the supply air along the entire length of the slot. While accessory devices help to correct the air flow pattern, proper approach conditions for the air stream are also highly important for satisfactory performance. Two different approaches are commonly used. With a *plenum* located behind the entire length of the outlet, the air must be introduced into the plenum from the main duct through dampered supply taps spaced approximately 4 ft from each other. The plenum should be sized for a maximum velocity of approximately 500 fpm. This low velocity is necessary for satisfactory air discharge. The taps feeding the plenum should be sized for a velocity of approximately 800 fpm. The use of a multiplicity of supply taps minimizes static regain.

If *tapered ducts* are used for introducing the supply air into the diffuser, they should be sized to maintain a velocity of approximately 500 fpm, and they must be *tapered* to maintain constant static pressure.

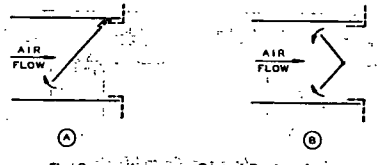

Fig. 2 Accessory Control Devices for Slot Diffuser Outlets

Air-Light Fixtures. Slot diffusers having a single slot discharge and nominal 2, 3, and 4 ft lengths, are available for use in conjunction with recessed fluorescent light troffers. The diffuser mates with the light fixture and is entirely concealed from the room. It discharges air through suitable openings in the fixture and is available with fixed or adjustable air discharge patterns, air distribution plenum, inlet dampers for balancing, and inlet collars suitable for flexible duct connections. Light fixtures adapted for slot diffusers are available in styles to fit the common ceiling constructions. Various slot diffuser and light fixture manufacturers can furnish products compatible with one anothers equipment.

Accessory Devices

Dampers are available as integral or separate standard equipment for use with slot diffusers. Generally the opposed-blade damper shown in Fig. 1A is used. However, in the case of narrow slot diffusers, it is often impossible to use an opposed-blade damper. In such cases, a single- or double-louver damper as shown in Fig. 2 must be used. This type of damper can generally be fully opened to 90 deg, and in this position does not restrict the capacity of the diffuser.

Flow equalizing vanes consist of a set of individually adjustable bars, installed behind the slot openings at right angles to the slot. If designed and installed correctly, they improve the discharge pattern of the diffuser (see section Discharge from a Long Slot in Chapter 29). For slots up to 36 in. in length, these bars may also be used to increase spread of the air stream for greater coverage. Dampers and flow-equalizing vanes can generally be adjusted without removing the diffuser.

Special Construction Features

Materials. Slot diffusers are made of steel or aluminum. Extruded aluminum diffusers conform to present-day architectural concepts, and can be easily modified to suit special requirements.

Finishes. Standard finishes, such as prime coat paint, lacquer, enamel, as well as electroplated and polished finishes are used in the manufacture of steel diffusers. Aluminum and extruded aluminum diffusers have polished and anodized finishes.

Special Features. Hand-hole doors, special friction spring mounting arrangements, special frames, hinges, reinforcements and other modifications to suit installation in various types of surfaces and materials are made to order.

CEILING DIFFUSER OUTLETS

Multi-passage round and square ceiling diffusers are the most common type of ceiling diffusers in general use. They consist of a series of flaring rings or louvers which form a series of concentric air passages, and for easy installation are usually made in two parts: an outer shell with duct collar, and an easily removable inner assembly. Ceiling diffusers are available as standard equipment ranging in duct collar sizes from 5 to 36 in. diameter.

Flush and *stepped-down* units are also available. In the flush unit, as the name implies, all rings or louvers project to a plane surface, whereas in the stepped-down unit they project beyond the surface of the outer shell. As a general rule, stepped-down units perform better than flush units, but flush units have a more pleasing appearance.

Common variations of this diffuser type are the *adjustable pattern* diffuser and the *multipattern* diffuser. In the *adjustable pattern* diffuser, the air discharge pattern may be changed from horizontal to a vertical or downblow pattern. This is done either by special construction of the diffuser itself, or by the use of separate deflection devices. Multipattern diffusers are square or rectangular in shape, and have special louvers to discharge the air in one or more directions.

Other outlets which are available as standard equipment are half-round diffusers, supply and return diffusers, and light fixture air diffuser combinations. Complete information on these outlets is given in manufacturers' catalogs.

Perforated-face ceiling diffusers meet architectural demands for air outlets which completely blend into perforated ceilings. They have a perforated metal face with an open area from approximately 20 to 50 percent which determines their capacity. Units with high capacity are equipped with a special deflection device to obtain a horizontal discharge pattern. Units with low capacity have no deflecting device, and discharge low volumes of air at low velocities. Installations using these diffusers must be carefully designed for satisfactory performance. These diffusers should not be used in critical applications.

Perforated-face ceiling diffusers must be distinguished from *perforated ceilings and perforated panels.* These devices discharge air through perforations in the ceiling or part of the ceiling, and share with slotted outlets the advantage of unobtrusive appearance. In addition, sound-absorbing materials may be used for the panels, or the panels may provide a luminous ceiling.

Outlet air velocities may be kept low by using large outlet areas, particularly in spaces with high room loads, high ventilating requirements, or low ceilings. Some perforated panels have a control plate frame which is inserted in the conventional ceiling duct. Supply air enters the plenum above the distribution plates through an adjustable air valve which can be set for varying air quantities and velocities.

Applications

Ceiling Installations. Ceiling diffusers should be mounted in the center of the space which they serve, because they discharge the supply air in all directions. Half-round diffusers are designed to be installed adjacent to partitions or in similar locations where round diffusers cannot be installed in the center of the conditioned space. Multipattern diffusers can be used in the center of the space, or adjacent to partitions, depending on the discharge pattern. By using different inner assemblies, their air pattern can be changed to suit particular requirements. This feature makes multipattern diffusers an excellent choice for modular room layouts with movable partitions.

Side Wall Installations. Half-round diffusers and multipattern diffusers, when installed high in side walls, should discharge the air towards the ceiling.

Exposed Duct Installation: Some ceiling diffuser types, particularly *stepped-down* units perform satisfactorily on exposed ducts. Consult manufacturers' catalogs for diffusers which can be installed on exposed ducts.

Adjustable Pattern Diffusers. Surface effect (see section Supply Air Outlets) is important in the performance of adjustable pattern diffusers. In fact, this effect is so pronounced, that usually only two discharge patterns are possible with adjustable pattern diffusers mounted directly on the ceiling. When the diffuser is changed from a horizontal pattern position towards the downblow pattern position, the surface effect will maintain the horizontal discharge pattern until a low pressure region is created under the center of the unit, which results in sudden vertical air discharge. Therefore, only horizontal and vertical discharge, but no intermediate discharge pattern is possible. However, when adjustable pattern ceiling diffusers are mounted on the exposed duct, there is no surface effect, and the air may assume any pattern between horizontal and vertical discharge.

Accessory Devices

Dampering and air straightening accessories of various types are available, as standard equipment.

Multi-louver dampers consist of a series of parallel blades mounted inside a round or square frame, and are installed in the diffuser collar or the take-off. The blades are usually arranged in two groups rotating in opposite directions (Fig. 3A), and are key-operated from the face of the diffuser. This arrangement equalizes air flow in the diffuser collar.

Opposed-blade dampers for round ceiling diffusers usually consist of a series of pie-shaped vanes mounted inside a round frame, and they are installed in the diffuser collar or the take-off. The vanes pivot about a horizontal axis, and are arranged in two groups, with adjacent vanes rotating counter to each other (Fig. 3B). The vanes are key-operated from the diffuser face.

Another opposed-blade damper is similar in construction to the damper shown in Fig. 1A, and has either a round or square frame.

Splitter Damper. A splitter damper is a single blade sheet metal plate hinged at one edge, and usually located at the branch connection of a duct or outlet (Fig. 3B). It is easy to operate, but often causes irregular air flow in the duct. When used in connection with, and near an outlet, additional directional control is required.

Equalizing devices provide uniform air flow in the diffuser collar, and consist of individually adjustable parallel blades mounted within a frame. They are installed in the diffuser collar or the take-off. If used in pairs at right angles to each other, they serve as both equalizing and directional control devices.

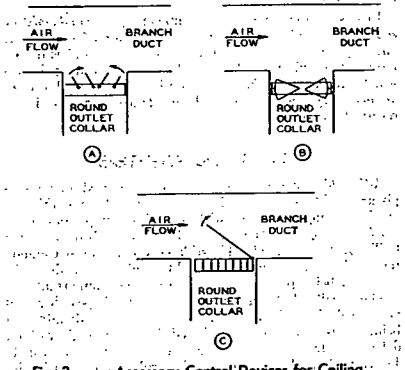

Fig. 3 Accessory Control Devices for Ceiling Diffuser Outlets