used in conjunction with the recirculating fans. For general offices in particular, or types of buildings having a large perimeter, the use of one of the induction type units for perimeter treatment, combined with a conventional system for the treatment of the interior portions, offers possibilities.

High buildings having large floor areas may be successfully handled in many ways. Horizontal or vertical sectionalizing or both may be required, as determined by economic factors and physical limitations. Where vertical sections only are required, the use of a single conditioner and fan for each section delivering conditioned air to zone fans at various floors may be used. These zone fans can be so arranged that one recirculating fan can handle similar zones on several floors, thus reducing the number of fans required and providing a degree of vertical zoning. Where vertical sectionalizing is not indicated, the building may be divided into horizontal groups, each group handled by a central system and adequately zoned. In some extremely large buildings apparatus rooms for the systems may be located in the basement and in the attic and on intermediate floors.

In high buildings having small floor areas the treatment required may be the same as for that of a vertical section of one having a large floor area. A single conditioner and fan can be used to deliver conditioned air to recirculating fans located at various floors.

In all cases of high buildings the necessity for horizontal sectionalizing is indicated by the economical size of air supply and return risers and by the extent to which they encroach upon usable space. In all buildings the necessity for vertical sectionalizing is indicated by the economical size of horizontal supply and return ducts and the space requirements of these ducts.

Usually the most simple systems are best adapted to theaters, auditoriums, and similar applications. Zoning is seldom required other than in connection with auxiliary spaces served by the same system. A conventional central system with by-pass control possibly augmented by reheat usually will suffice. The auxiliary spaces may be supplied with air from the same system controlled by volume reduction and reheat. Balconies and large lobbies frequently justify the use of separate zoning fans.

The foregoing are merely generalizations and suggestions. It is the responsibility of the engineer to explore thoroughly the possibilities of all types of systems and employ that best suited to the purpose from a standpoint of maintained economy, maintenance, life, operation and physical applicability.

EQUIPMENT SELECTION

Other chapters cover in detail most of the items of equipment used in a central system. Each item must be selected not only on its own merits, but in relation to all the other items that go to make up the complete central system. Each item should be considered from the standpoint of both initial cost and operating costs. Consideration must be given to performance at partial loads since most systems operate at full load but a small percentage of time. Many items of equipment have been well standardized and are manufactured in certain definite sizes. The fullest advantage of this should be taken. One item that may be oversized of necessity may permit the use of a smaller piece elsewhere.

Fans operate at full capacity continually in many systems and therefore should be selected for good efficiencies. In winter where higher temperature differentials are used it is possible to use lower air quantities and a two-speed motor may be provided for the fan, resulting in a power saving. In such cases the air distribution under the reduced volume should be investigated before providing this feature.

In selection of the dehumidifier or conditioner the relation of this item to the refrigeration plant is to be given careful consideration. Frequently, it is possible to make a saving in the refrigeration plant by providing more surface in the dehumidifier or conditioner. On the other hand, an excess of capacity in the refrigeration plant can be used to lower the apparatus dew-point (if the lower room humidity is satisfactory) resulting in a reduced quantity of dehumidified air and smaller dehumidifier.

In winter, where preheating coils in outside air intakes are required and subjected to entering air temperatures below freezing, the coils should be selected for operation at full capacity whenever the entering air temperature is below 35 F or where throttling of the steam supply to the coils is desirable. A type of coil that is designed especially for this must be used. In many cases the use of preheaters is not justified since the temperature of the mixture of outside and return air may be entirely satisfactory.

Where reheating coils are used after the supply fan, either as zone control reheaters or boosters, and are relatively near outlets, care is to be used to install these coils so that any stratification of temperature produced by the throttling of the steam or water supply does not result in cold air being delivered to one outlet and warm air to another. Some types of coils that do not produce stratification under throttled conditions are commercially available.

The selection of the refrigerating plant is in itself an economic study. The availability, consumption, and costs of condenser water are to be compared to the initial costs involved and water savings produced by the use of cooling towers or evaporative condensers. Whether or not a direct expansion or flooded system, cold water or brine type of plant will be used is not only a matter of initial cost but one of over-all performance, operating economy, compactness, and in some cases, one of safety. Where water or brine is used as a cooling medium, the possibilities of using lower temperatures and decreased quantities of water or brine, with resultant savings in pumping power and line sizes, are to be compared with the increased power consumption and probable increased cost of the refrigeration machine.

Air cleaning devices are to be selected according to the particular requirements of the project as well as to existing atmospheric conditions. In some applications such as certain types of stores or departments in large stores, lint screens should be provided for the return air as well as filters. Whether or not return air is to be filtered will depend upon the individual case and will be related to the amount of dirt or dust generated in or brought into the conditioned space from various sources. The type of filter or cleaning device to be used depends largely on economic considerations. Obviously an expensive high efficiency cleaning device is not warranted where atmospheric dust or dirt is of such a nature that a less expensive, less efficient device will remove the more objectionable matter. Interior cleaning costs, dust and dirt damage, and hazard due to an accumulation of inflammable dust or dirt within the system are most important factors.

Automatic instruments are nearly always used in present practice for the control of temperature and humidity and to an increasing extent in the control of large refrigerating plants as well as small ones. Whether