plished with a separate humidifier system. On small installations, the simplest method is to use a warm water spray through atomizing nozzles, using a pressure of 15 to 25 lb and sufficient nozzles to atomize about twice the amount of water needed for humidifying. The grains of moisture to be added to the incoming air at outside design temperature to bring it up to the required room dew-point are calculated. This is converted to total pounds of water per hour for the system and sprays designed for twice this amount. Cold water will not vaporize as completely as warm water, and water temperatures from 120 to 150 F are commonly used. Another method is to install a water tank in the air stream with a steam coil submerged in the tank, the humidification being accomplished by the steam boiling the water into vapor, which in turn will be absorbed by the passing air. In both of these systems there is a tendency to deposit lime and other impurities on any surface the water touches, and this scale should be cleaned regularly before it becomes excessive. Water spray should not touch the steam heating coils as they will quickly become coated with scale. The preferred practice is to install sprays between coils and eliminator plates.

Sound Control

Problems of sound control should be jointly considered by the acoustical and air conditioning engineer for satisfactory results. Many installations require noise levels which are relatively low and for that reason equipment must be selected having a very low noise rating. In central systems consideration should also be given to the lining of ducts for the reduction of noise levels within an enclosure. Often reduced speeds of equipment and low air velocities are helpful in eliminating undesirable noise conditions. Information is given in Chapter 30 with regard to acceptable noise levels for various types of rooms and methods are outlined for computing length of duct lining materials.

Automatic Control

The control of an air conditioning system is very important. A simple comfort cooling or heating installation requires a minimum of control, whereas a more complex installation justifies a more complete control. In this connection, it should be mentioned that there are many patents allowed and pending on air conditioning equipment including control, and the designer should consider these factors in selecting all of the equipment. Refer to Chapter 37.

Static Pressure

The total static pressure against which the system must operate may be found by summing up the static losses through the complete system from the outside air intake to the discharge outlets or nozzles. This means that the loss due to friction must be determined for each piece of apparatus involved. Most of these values may be obtained from manufacturers' data tables. For a simple system, the following static pressure drops may be assumed.

1. Outside air inlet, comprised of screen, louver and short duct, may have a loss of 0.2 in. of water.

2. A typical viscous filter at rated capacity and velocity has a drop of 0.25 in. water.
3. The loss of one row of a standard make tempering stack equals 0.09 in. water.
4. The loss of one row of a standard make preheater equals 0.10 in. water.
5. A standard humidifier at rated velocity may have a loss of about 0.35 in. water.
6. The loss through one row of a standard make reheater equals 0.12 in. water.
7. A fair assumption for duct losses on a simple system is 0.25 in. water.
8. The static pressure for a nozzle type outlet may be taken as 0.1 in. water.

The sum of these values equals $0.2 + 0.25 + 0.09 + 0.10 + 0.35 + 0.12 + 0.25 + 0.1 = 1.46$ in. which is the static pressure against which the system must operate.

Fans, Motors and Filters

The selection of Fans may be based on data contained in Chapter 27 and for Motors in Chapter 38. Because centrifugal fans reach their maximum efficiency when working against the resistance offered by the average central fan heating system, they are well adapted to such systems and are generally used. Complete information is given in Chapter 26 for the selection of all types of air filtering equipment.

SPECIAL CONSIDERATIONS

In designing a central system for air conditioning there are a number of special considerations not referred to previously which must be considered. Certain features of building constructions are important. The building must be suitable in construction so that the conditions designed can be maintained economically.

For instance, excessive sun load on roofs or glass windows may not only cause excessive heat gain to be absorbed by refrigeration, but direct sun radiation heating converts a surface into a panel heater. This radiant heat is not absorbed until it strikes another mass such as a building wall, or a person. It is therefore possible to have comfortable air conditions surrounding a person, and yet have him uncomfortably warm from radiant heat from a hot wall, window, or ceiling near him. As another example, it is much better to provide hoods over steam tables, coffee urns, etc., than to try to remove this heat by mechanical refrigeration.

Another problem is presented with winter conditioning for maintaining satisfactory relative humidity. If 30 to 40 per cent is desired at all times, no matter how cold it is outside, excessive condensation may collect on single glass windows, or on hardware which connects to the outside such as latches and hinges. Condensation on windows can sometimes be prevented by applying a small amount of local heat under the window. In other cases double glass or storm window construction is used. Refer to Chapters 5 and 7 for condensation temperatures.

In many cases, different zones of a building will require entirely different treatment. In some buildings where offices are exposed on all four sides to sun and wind effect, cooling is required on the sunny side and heating is required on the shady side simultaneously, in spring and fall seasons. The central system must be carefully zoned to apply cooling or heating as they may be needed for each zone, independent of other zones.

In many existing buildings, the central system will be added to a radiation system of heating. The designer should take full avantage of