

The addition of a cooling coil and compressor turns the system into a complete year-round conditioner.

### Reheating

When air is dehumidified by cooling, the dry-bulb temperature leaving the dehumidifier is frequently lower than desired at the supply grille. In these cases, the dehumidified air must be reheated, and such reheating may be accomplished either by by-passing some air around the dehumidifier<sup>2</sup> (Fig. 2), or by using reheating coils.

Study of Figs. 1 and 2 will make it obvious that without the by-pass,

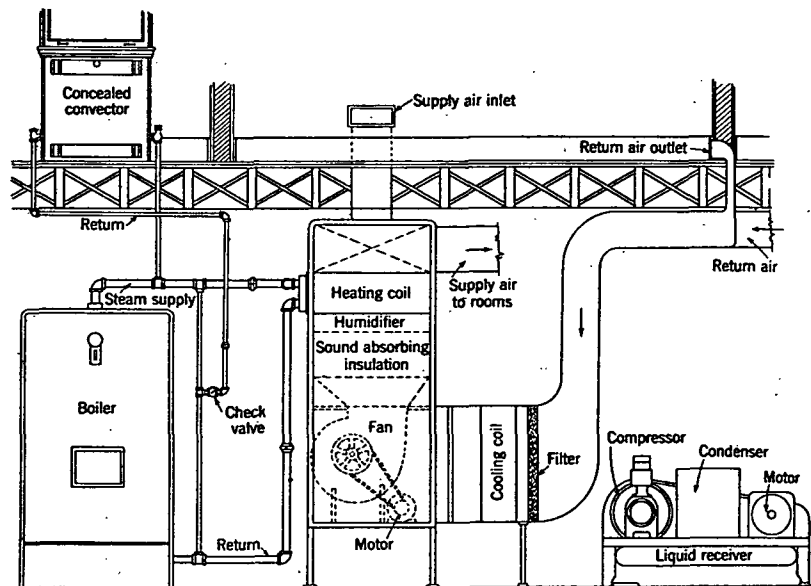


FIG. 6. RESIDENTIAL CONDITIONING SYSTEM WITH STEAM BOILER

all of the air is first cooled and then subsequently reheated, but with the by-pass, only part of the air is cooled, heat required for reheating being supplied by by-passed air. The by-pass thus reduces the cooling load and makes a separate reheating source unnecessary.

### DESIGN OF SYSTEM

The factors which affect the design of an air conditioning system and the steps in the design are enumerated herewith.

#### Item 1. Design conditions.

- Outside dry-bulb temperature in winter.
- Outside dry- and wet-bulb temperatures in summer.
- Inside dry- and wet-bulb temperatures (winter and summer).

<sup>2</sup>Patents exist covering the by-pass method.

#### Item 2. Design heating load.

- Heat transfer through windows, walls, partitions, doors, floors, skylights, roofs.
- Heat loss resulting from infiltration.
- Heat required to warm ventilation air.
- Heat required to evaporate moisture for humidification.
- Heat loss through ducts and coil housings.
- Allowances for heat emitting sources.

#### Item 3. Design cooling load.

- Heat transfer through windows, walls, partitions, doors, floors, skylights, roofs, including solar radiation.
- The sensible and latent heat emission of occupants.
- Heat emission of electrical, chemical, gas, steam or hot water apparatus, or lights (divide into sensible and latent heat).
- The sensible and latent heat gains resulting from infiltration.
- Sensible and latent heat to be removed from ventilation air.
- Heat gain through ducts and coil housings.

#### Item 4. Design of the air conditioning system.

- Establish the air temperatures at supply grilles for winter and summer.
- Calculate the air quantities for winter and summer.
  - Adjust factors to get most satisfactory balance between winter and summer air quantities.
- Select coils, washers, heat exchangers, etc., with capacities equal to heating and cooling loads established in Items 2 and 3.
- Select air cleaning equipment.
- Select fans.
- Design duct system including supply and return grilles.
- Consider noise reduction problems.
- Design the control system.
- Calculate static pressure loss of the complete system.
- Select fan motors and drives and other auxiliary equipment.

### Design Conditions

Outside design temperatures for principal cities are found in Chapter 5 for the heating season and in Chapter 6 for the cooling season. Recommended inside design temperatures for various types of buildings and for the seasons are found in Chapters 2 and 5.

### Load Calculations for Heating

Complete tabular information is given in Chapter 3 for determining the heat loss through windows, walls, partitions, doors, floors, skylights, ceilings and roofs.

The heating capacity required to warm infiltration air is determined by methods shown in Chapter 4.

The minimum quantity of outside air brought in for ventilation is sometimes fixed by law; but when this is not the case, the A.S.H.V.E. Code<sup>3</sup> should be used as a standard. Outside air in sufficient quantities provides the best method of controlling objectionable odors, and the design should err on the safe side.

Code requirements state that the assumed rate at which air is to be positively introduced into the enclosure per occupant, when the contamination of air within the enclosures results entirely from respiratory process, shall not be less than 10 cfm per stated number of occupants

<sup>3</sup>Loc. Cit. Note 1.