

AUTOMATIC CONTROL

Automatic temperature control readily can be used on the trunk line system of ducts by volume control of the warm air at the supply openings, and on the double duct and individual duct systems by double-leaf mixing-damper control of the warm and tempered air. For mild climates the tempered air may be taken from the space under the furnaces; in which case the intermediate type thermostat is recommended. In colder climates the air may be tempered by conducting a portion of the warm-air supply from the plenum space over the heaters to the fan inlet, the duct connection having a damper controlled by a thermostat in the fan-outlet connection. Again, a tempered-air plenum chamber may be provided over the warm-air plenum chamber, arranged so that a double-leaf mixing damper regulates a mixture of air from the fan (by-passing the heater) and air from the warm-air plenum chamber controlled by a thermostat in the tempered-air plenum chamber.

Automatic control of humidity can be secured by means of sprays or by air washers. When air washers are employed it is necessary to introduce a warm-air supply in front of the air washer or to use heated water to prevent freezing when using outside air.

Control of various units of a plant can be easily arranged by electric or pneumatic cut-off dampers. This will provide means of heating portions of the building only. Remote control of outside air dampers working in unison with ventilator dampers where the exhaust outlets are used, will make the operation of the plant easier.

FAN FURNACE AND AIR CONDITIONING SYSTEMS FOR RESIDENCES AND SMALL BUILDINGS

The field of fan-furnace heating has been extended to include residences and other small buildings through the development of equipment which incorporates in single units all devices necessary for filtering, for humidifying, for temperature regulation, for forcing a positive delivery of the air. Some manufacturers enclose the heater, fan, filters and humidifier in a cabinet casing of neat appearance.

The most important characteristics of the fan-furnace system for small buildings are as follows:

1. The registers may be placed in outside walls, or under windows, or at any location above floor line on inside walls, contrary to practice in gravity work.
2. The heater location need not be central, and its location may be determined by proximity to the chimney.
3. Pipes may be of small size and need not be given a slope to aid the flow.
4. Cold-air returns may be placed with a view to securing the most advantageous collection of return air without sacrificing efficiency.
5. Remote rooms may be heated satisfactorily because the system provides a positive delivery of conditioned air to each room.
6. All air may be filtered to remove dust.
7. The fan may be used for circulating air when no fuel is being burned.

Distributing Systems

Fan furnaces of this type are adaptable either to trunk line duct systems, to central chambers, or to individual pipe installations, the size and shape of building being the governing factors. The supply of air to individual rooms may be made with small branches, 6 in. and 8 in. diameters being used. These branches and also the main trunk lines may be either round or rectangular. Risers and registers of commercial sizes in use in gravity warm air heating practice are adaptable.

The basic principles of proportioning ducts apply to this system as well as to the larger fan systems. The velocity of air through the ducts depends upon the power furnished by the fan and motor, the limiting factors being economy and quiet operation. Both supply ducts and return air systems should be based upon equal friction throughout the design to assure proper circulation. The following velocities have been found satisfactory:

Over nominal area of registers.....	200-300 ft per minute
Branches and stacks.....	400-600 ft per minute
In main ducts of trunk system.....	500-800 ft per minute
In returns.....	500-700 ft per minute

Higher velocities may be used when provision is made for minimizing air noise and supplying sufficient pressure.

Equalization of the air flow can be based upon equal friction for the entire duct system. With a central distributing system, standardized orifices, calibrated in terms of cubic feet, may be used. In this case all pipes may be the same size and the flow balanced by the orifices. It is desirable where orifices are not used to install equalizing dampers in all runs. Return air openings should provide easy recirculation to the central fan and should be cushioned against noise by sound deadening.

Coal-Fired Fan Furnaces

Small size coal-fired fan furnaces are available. These include air filters and humidifiers all arranged in a compact unit. Provision should be made for automatically regulating the fuel consumption and thereby the air temperature. It is desirable that such control also regulate the operation of the fan so as to prevent overheating. The use of by-pass dampers will allow gravity circulation of air and will also prevent damage to heater from overheating.

Gas-Fired Fan-Furnace System

For gas fuel, high efficiencies have been obtained through the use of large areas of heating surface concentrated in banks of plate heaters through which the air is forced at high velocity. High operating efficiencies, further, are assured through the use of throttling gas valves, which, actuated by thermostats, proportion the consumption of fuel to the demand for heat, and thereby lessen the losses due to excessive flue temperatures and radiation.

When high efficiencies are attained in gas-fired units provision must be made for disposal of the condensation formed in the passages of the