

of heating surface to grate area. Neither this correction, nor the Standard Code⁴ Ratings, apply to values of the ratio less than 15 and greater than 30.

Fig. 5 represents Laboratory data on a typical furnace, illustrating the fact that for a given register temperature, each furnace will have a definite capacity and efficiency, and will require a certain chimney draft to draw the air for combustion through the fuel bed. Test data gathered on the basis of the register design temperature of 175 F, permit rearranging the formula for Equation 1 into the following form:

$$G = \frac{144 \times H}{7.5 \times 12,790 \times 0.55 \times 0.75 \times 0.866 [1 + 0.02 (R-20)]} \quad (2)$$

$$G = 0.004205 \frac{H}{[1 + 0.02 (R-20)]} \quad (3)$$

As used in Equations 2 and 3, H equals the hourly heat loss of the entire building, in Btu per hour, including the heat required to warm any outdoor air introduced through a fresh air duct.

Figs. 6 and 7 show recommended practice as given in the *N.W.A.H. & A.C. Assn. Standard Code Application Manual*.

⁴Standard Gravity Code for the Design and Installation of Gravity Warm Air Heating Systems in Residences. This code has been sponsored by the National Warm Air Heating and Air Conditioning Association, the National Association of Sheet Metal Contractors, and the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. It is recommended that the installation of all gravity warm-air heating systems in residences be governed by the provisions of this code, the eleventh edition of which may be obtained from the National Warm Air Heating and Air Conditioning Association.

CHAPTER 20

Mechanical Warm Air Furnace Systems

Furnaces, Fans and Motors, Filters, Air Distribution, Automatic Controls, Design of Heating System, Selecting the Furnace, Selecting the Fan, Heavy Duty Fan Furnaces, Humidification, Cooling Methods, Cooling System Design

IN mechanical warm air or fan furnace heating systems¹, the air circulation is effected by motor-driven fans instead of by the difference in weight between the heated air leaving the top of the casing and the cooled air entering the bottom, as in gravity systems described in Chapter 19. The advantages of mechanical systems, as compared with gravity systems, are:

1. The furnace need not be centrally located but may be placed in any part of the basement.
2. Basement distribution piping can be made smaller and can be so installed as to give full head room in all parts of the average basement, or be completely concealed from view where desired.
3. Circulation of air is positive, and in a properly designed system can be balanced in such a way as to give a greater uniformity of temperature distribution.
4. Humidity control is more readily attained.
5. The air may be cleaned by sprays or filters, or both.
6. The fan and duct equipment may be utilized for a complete cooling and dehumidifying system for summer, using either ice, mechanical refrigeration, or low temperature water for cooling and dehumidifying, or adsorbers for dehumidifying.
7. The use of the fan increases the volume of air which can be handled, thereby increasing the rate of heat extraction from a given amount of heating surface and insuring sufficient air volume to obtain proper distribution in a large room.
8. Ventilation air may be positively introduced and heated.

FURNACES

Cast-iron furnaces are usually made in sections and are assembled and cemented or bolted together on the job. Steel furnaces are made with welded or riveted seams. The proper design of the furnace depends largely on the kind of fuel to be burned, and special units are being made

¹Specifications for the furnace unit and the installed duct system are shown in The Yardstick for the Evaluation of a Forced Warm Air Heating System and in Winter Air Conditioning—Forced Warm Air Heating, by S. Konzo, published by National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland, Ohio.