Leader diameter = 11.4, say 12 in.

Stack area = 0.7 × 90 = 63 sq. in. = say 5 × 12 in.

Register area = 90 sq. in. net area. Gross area = 1.6 × net area = 12 × 12 or 12 × 14 in.

In like manner the leaders, stacks and registers are calculated for each room in the house.

Leaders, Stacks and Registers. **(*Code Method. See Art. 3, Sec. 1, 2, 3.*)**

Living Room (Glass = 90, Net wall = 405, Cubic contents = 2405)

$$\text{Leader} = \left(\frac{90}{12} + \frac{405}{60} + \frac{2405}{800}\right) 9 = 155 \text{ sq. in.}$$

Register, same as Direct Method.

Owner's Room (Glass = 68, Net wall = 394, Cubic contents = 2275)

$$\text{Leader} = \left(\frac{68}{12} + \frac{394}{60} + \frac{2275}{800}\right) 6 = 90 \text{ sq. in.}$$

Stack and Register, same as Direct Method.

Assuming all air recirculated, the minimum furnace for the plant will be:

Grate Area = 0.0034 × 132,370 = 450 sq. in. = 24 in. diam. at 175 deg. register temperature. (7)

Grate Area = 0.0040 × 132,370 = 530 sq. in. = 26 in. diam. at 160 deg. register temperature. (8) (10)

If provision shall be made for certain outside air circulation, then increase the building heat loss by, say 25 per cent and obtain by equation (7) a 27-in. grate and by equations (8) and (10) a 29-in. grate.

SUMMARY OF DATA APPLIED TO WARM AIR RESEARCH RESIDENCE

Rooms	From Chapter I on Heat Losses from Buildings B.t.u. Heat Losses *H*	Leader Area Sq. In.	Stack Area Sq. In. 0.7 × *LA*	Leader Diameter Inches	Stack Size Net	Register Size Gross
First Floor		= 0.009*H*				
Living	17250	155	....	14	.....	14 × 18
Dining	6810	61	....	9	.....	8 × 12
Breakfast	2300	21	....	8	.....	8 × 10
Kitchen	9210	83	....	11 or 12	.....	12 × 14
Sun	25710	230	....	Two 12	.....	Two 12 × 14
Hall and stair	12570	113	....	12	.....	12 × 14
Second Floor		= 0.006*H*				
Owners	15030	90	63	11 or 12	5 × 12	12 × 14
S. W. Bed	9800	59	41	9	3½ × 12	8 × 12
Bath	2450	15	10	8	3 × 10	8 × 10
N. Bed	14800	89	62	11 or 12	5 × 12	12 × 14
Third Floor		= 0.005*H*				
E. Bed	8220	41	29	8	3 × 10	8 × 10
W. Bed	8220	41	29	8	3 × 10	8 × 10

STANDARD CODE REGULATING THE INSTALLATION OF GRAVITY WARM AIR FURNACES IN RESIDENCES[3]

FIFTH EDITION
March 1, 1928

ARTICLE No. 1.—Meaning of the Term "Gravity Warm Air Furnace Heating System"

Gravity Warm Air Heating Systems, to which this code refers, shall consist of one or more warm-air furnaces, enclosed within casings, together with necessary appurtenances thereto, consisting of warm-air pipes and fittings, cold air or recirculating pipes, ducts, boxes and fittings, smoke pipes and fittings, registers, borders, faces and grilles, the same being intended for heating buildings in which they may be installed.

ARTICLE No. 2.—Chimneys

a. The owner shall provide a chimney for the furnace constructed in a manner to comply with the following specifications.

b. The chimney must be absolutely smoke tight throughout its entire length, and must extend at least three feet (3′) above a flat roof or two feet (2′) above the ridges of peak roofs.

c. If built of a single thickness of brick or of cement blocks, it shall be lined throughout its entire length with fire clay flue lining, having not less than three-fourths inch (¾″) thickness. Flue lining to be laid in mortar and made air-tight.

d. The furnace flue must have no other opening for attaching any fireplace, furnace, stove, range, water heater, gas or ventilating connection.

e. If necessary to offset the flue, it must be done in such a manner as not to reduce the cross sectional area or create a ledge or obstruction, where loose material may lodge.

f. Its narrowest internal dimension shall not be less than eight inches (8″) and no flue smaller than 8″ x 8″ rectangular or eight inch (8″) diameter round will be considered suitable when hard coal is to be burned, or 8″ x 12″ rectangular or ten inch (10″) round for soft coal or wood.

g. It is strongly recommended that nothing less than 8″ x 12″ internal dimensions be used in any case.

Note 1.—It is recommended that the height above the furnace grate be not less than twenty-six feet (26′)

Note 2.—It is strongly recommended that all new chimneys be built in strict accordance with the ordinance recommended by the *National Board of Fire Underwriters.* (For further data on Chimneys, see Chapter VI).

ARTICLE No. 3.—Method for Determining Sizes of Warm Air Pipes, Wall Stacks and Furnaces for Use in Residences

Method for Determining Sizes of Basement Warm Air Pipes

Section 1. Each First Floor Room.

Divide square feet of glass by 12.
Divide square feet of net outside wall by 60. (See Table A)
Divide cubic contents by 800.
Add together the above and multiply by 9.
The result is the area of the basement pipe in sq. in.

$$\left\{\begin{array}{l}\text{The sum of:}\\ \text{Glass (sq. ft.) } (\textit{Note 3}) \div 12\\ \text{Net Wall (sq. ft.) } (\textit{Note 4}) \div 60\\ \text{Cubic Contents} \div 800\end{array}\right\} \times 9 = \text{Area of Basement Pipe}$$

Section 2. Each Second Floor Room.

Divide square feet of glass by 12.
Divide square feet of net outside wall by 60. (See Table A)

[3]This Code is approved and issued by authority of the *National Warm Air Heating Association*, THE AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS and the *National Association Sheet Metal Contractors*. First edition, October 1, 1922; 2nd edition, February 1, 1923; 3rd edition, June 1, 1924; 4th edition, May 1, 1927.