

CHAPTER 19

Gravity Warm Air Furnace Systems

Warm Air Leaders, Stacks, and Registers; Return Air Ducts, Grilles, and Shoe Connections; Outline of Design Procedure; Furnace Capacity

WARM air heating systems of the gravity type are described in this chapter¹, and those of the mechanical type are described in Chapter 20. In the gravity type, the motive head producing flow depends upon the difference in weight between the heated air leaving the top of the casing and the cooled air entering the bottom of the casing, while in the mechanical type a fan may supply all or part of the motive head. Booster fans are often used in conjunction with gravity-designed systems to increase air circulation.

In general, a warm-air furnace heating plant consists of a fuel-burning furnace or heater, enclosed in a casing of sheet metal or brick, which is placed in the basement of the building. The heated air, taken from the top or sides near the top of the furnace casing, is distributed to the various rooms of the building through sheet metal warm-air pipes. The warm-air pipes in the basement are known as leaders, and the vertical warm-air pipes which are run in the inside partitions of the building are called stacks. The heated air is finally discharged into the rooms through registers which are set in register boxes placed either in the floor or in the side wall, usually at or near the baseboard. A sectional view of a typical plant showing good installation practice is given in Fig. 1.

The air supply to the furnace is usually taken entirely from inside the building through one or more recirculating ducts, although in some cases an outside air supply duct is provided.

WARM AIR LEADERS, STACKS, AND REGISTERS

In a gravity circulating warm-air furnace system, the size of the leader pipe to a given room depends upon the length of the leader and the tem-

¹The engineering data which follow are from University of Illinois, *Engineering Experiment Station Bulletins* Nos. 141, 188, 189 and 246; *Warm Air Furnaces and Heating Systems*, by A. C. Willard, A. P. Kratz, V. S. Day, and S. Konzo. See also *Standard Code Application Manual for Gravity Warm Air Heating Systems*, published by the *National Warm Air Heating and Air Conditioning Association*.

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perature of the warm air entering the room at the register. For most successful operation, the furnace should be centrally located with respect to register and stack positions so that the leaders will be of uniform length and as short as possible, in which case the frictional resistance to air flow and the temperature loss from the ducts will be about the same for all runs.

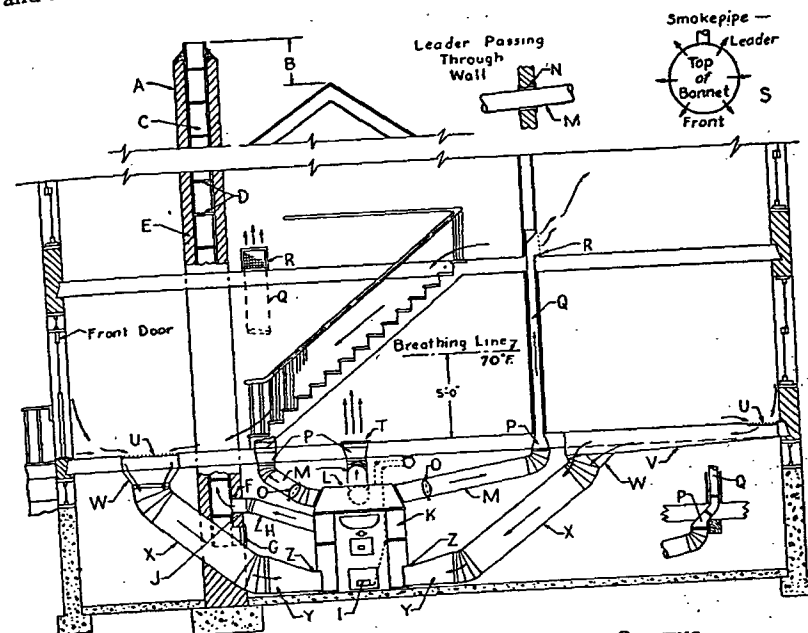


FIG. 1. A SECTIONAL VIEW OF A TYPICAL PLANT SHOWING GOOD INSTALLATION PRACTICE^a

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| A. House chimney, no bends nor offsets. | N. Sleeve with air space around leader where passing through wall. |
| B. Top of chimney at least 2 feet above ridge of roof. | O. Dampers in all leaders. |
| C. Flue lining, fireclay. | P. Transition fittings. |
| D. All joints air tight. | Q. Rectangular wall stack. |
| E. At least 8 in. brick. | R. Baseboard register. |
| F. No other connection beside that to furnace. | S. Distribute pipes equally around bonnet. |
| G. Cleanout frame and door, airtight. | T. Floor register. |
| H. Smoke pipe, end flush with inner surface of flue. | U. Return air face. |
| I. Draft door. | V. Panning under joist. |
| J. Use flue thimble. | W. Transition collar. |
| L. Casing hood or bonnet, top of all leader collars on same level. | X. Round return pipe. |
| K. Casing body. | Y. Transition shoe. |
| M. Round leader, pitch 1 in. per foot. | Z. Top of shoe at casing not above grate level. |

^a(From N.W.A.H.&A.C. Assn. Standard Code Application Manual).

In the Standard Code for Installation of Gravity Warm Air Heating Systems, the design was originally based on the heat carrying capacities per square inch of leader pipe area, as shown in Table 1. These values were based on register air temperatures of 175 F. In a recent revision of the entire design procedure, as outlined in the section entitled *Outline of*