size in the case of rectangular ducts. Warm air ducts passing through cold spaces or located in exposed walls, should have 1 to 2 in. of insulation.

Special attention should be given to the problem of noise elimination. The metal duct connection to and from the furnace casing and fan housing should be broken by strips of canvas. Motors and mountings must be carefully selected for quiet operation. Electrical conduit and water piping must not be fastened to, nor make contact with the fan housing. Installation of a fan directly under a return air grille is usually avoided.

STANDARD COMBINATIONS OF PARTS

The combinations of parts selected as standard by the *National Warm Air Heating and Air Conditioning Association* are shown in Tables 1 and 2. A method for selecting these combinations is indicated in the following section Simplified Method of Design.

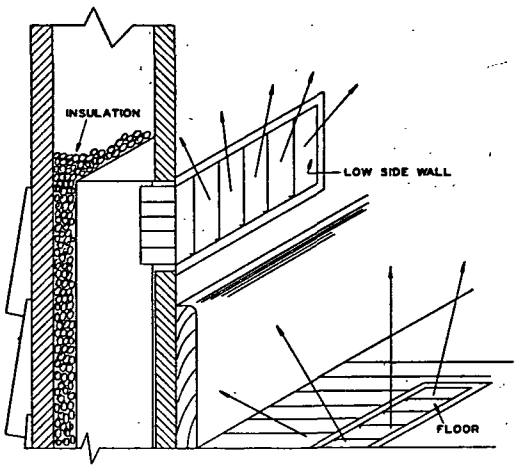

FIG. 3. RECOMMENDED TYPE OF FLOOR OR LOW SIDEWALL INSTALLATION ON OUTSIDE WALL[c]

[c] Registers set to direct air upward along the wall at as wide an angle as possible.

SIMPLIFIED METHOD OF DESIGN

A simplified method for selecting the combinations of branches, boots, stacks, and registers, is given[3] in Manual 7 of the *National Warm Air Heating and Air Conditioning Association*. In this method, the sizes of the branch ducts are obtained from two tables giving their Btu capacities. The proper combination of parts for each branch can be determined if the following information is available.

a. Location of room, that is, whether on first or second story.

b. Actual horizontal length of duct from bonnet to boot, in feet.

c. Btu loss from room to be heated.

d. Equivalent lengths in feet of all fittings and of the register. Fig. 4 shows the values of equivalent lengths of fittings commonly used for domestic systems.

This simplified method is applicable to structures having heat losses not in excess of approximately 120,000 Btu per hour. The capacities shown in Tables 3 and 4 are based upon the most reliable data pertaining to friction losses and temperature drops in ducts. They are also based upon a 100 deg temperature rise of the air, and a static pressure available for overcoming friction losses in the external duct system alone of 0.20 in. water gage. The use of this method assumes that the fan in the fan-furnace assembly will be capable not only of overcoming the resistance of the external duct system alone, but also the resistances imposed by the blower inlet, the filter, and the furnace casing. The combination numbers shown in the right hand column of Tables 3 and 4 correspond to those given

TABLE 1. WARM AIR DUCT SYSTEM COMBINATIONS OF PARTS SELECTED AS STANDARD

Combination No.	Stack Size, In.	Branch Pipe, Size In.		Register Size, In. (See Figs. 1, 2, 3 and 4)			Required Increase in Width of Trunk Duct, In.
		Round	Rectangular	Base-board High or Low Sidewall	Floor Registers[a]		
					Perimeter	Replacement	
1	2	3	4	5	6	7	8
41	10 x 3¼	5	3 x 8	10 x 6	4 x 12	8 x 10[a]	1
42	10 x 3¼	6	4 x 8	10 x 6	4 x 12	8 x 10[a]	2
43	12 x 3¼	7	5 x 8	12 x 6	4 x 14	9 x 12[a]	3
44	14 x 3¼	8	6 x 8	14 x 6	6 x 14	9 x 12[a] or longer	4
45	10 x 3¼ (2-Stacks)	9	8 x 8	(2) 10 x 6 or (1) 24 x 6	(2) 4 x 12	10 x 12[a]	5
46	12 x 3¼ (2-Stacks)	10	10 x 8	(2) 12 x 6 or (1) 30 x 6	(2) 4 x 14	12 x 14[a]	7

[a] Use these items only when the installation necessitates the use of existing floor openings. The sizes listed for floor registers correspond to the standard sizes for gravity warm air furnace systems, except for the sizes of the floor box collars. The use of standard blind boxes is suggested. A 12 x 5¼ in. stack may be used on Combination 45, and a 14 x 5¼ in. stack on Combination 46 with floor registers.

in Tables 1 and 2. Tables 3 and 4 are also applicable for the selection of the return air branches. A depth of 8 in. has been adopted as the standard for the trunk ducts. The width of a trunk duct serving two branches is determined by adding to the width of the remote branch the value shown in column 8 of Table 1, or column 8 of Table 2.

DESIGN PROCEDURE FOR LARGE SYSTEMS[4]

For buildings having a heat loss in excess of 120,000 Btu per hour, the design procedure[5] given in Manual 9 of the *NWAH & ACA*, may be used. Work sheets 9a, 9b, and 9c are available to simplify calculations.[4] The procedure consists of:

1. Calculation of design heat losses from individual spaces in the structure. The calculation of these losses is explained in Chapter 12.