of the internal and surface resistances of the construction. The solution of Example V in Fig. 3, by means of the resistance method is given in the following tabulation:

MATERIAL	THICKNESS INCHES	INTERNAL CONDUCTIVITY (C or C_u)	SURFACE COEFFICENTS (K_1 or K_2)	INTERNAL RESISTANCE	SURFACE RESISTANCE
Brickwork	13	5.0 (C)	4.02 (K_2)	2.600	0.249
Cement Mortar	½	8.0 (C)	....	0.063	....
Hollow Clay Tile	2	1.14 (C_u)	....	0.877	....
Plaster (gypsum)	½	2.32 (C)	1.34 (K_1)	0.215	0.746
				3.755	0.995
					3.755
Total resistance (R)					4.750

$U = \frac{1}{R} = \frac{1}{4.750} = 0.210$ B.t.u. per hour per sq. ft. per 1 deg. fahr. difference in temperature between the air on the two sides of the wall.

The thicknesses upon which the coefficients in Tables 6 to 11, inclusive, are based, are as follows:

Brick veneer	4 in.
Plaster and metal lath	¾ in.
Plaster [on wood lath, plasterboard, fiber insulation (board form), or corkboard]	½ in.
Slate (Roofing)	½ in.
Stucco on wire mesh reinforcing	1 in.
Tar and gravel or slag surfaced built-up roofing	⅜ in.
Wood shingles (average thickness)	⅝ in.
Wood siding or clapboard (average thickness)	⅝ in.
1-in. Lumber (S-2-S)	$\frac{25}{32}$ in.
1½-in. Lumber (S-2-S)	$1\frac{5}{16}$ in.
2-in. Lumber (S-2-S)	1⅝ in.
2½-in. Lumber (S-2-S)	2⅛ in.
3-in. Lumber (S-2-S)	2⅝ in.
4-in. Lumber (S-2-S)	3⅝ in.
Finish flooring (Maple or Oak)	$\frac{13}{16}$ in.

Note that actual thicknesses of lumber are used in the computations rather than nominal thicknesses.

On account of the fact that the internal resistances of metal and single thicknesses of building paper* and roofing felt are very small, these resistances were neglected in the calculations, in accordance with standard practice. The computations for wood shingle roofs applied over wood stripping are based on 1 by 4 in. wood strips, spaced 2 in. apart. Since no reliable figures are available concerning the conductivity of Spanish and French clay roofing tile, of which there are many varieties, the figures for such types of roofs were taken the same as for slate roofs, as it is probable that the values of U for these two types of roofs will compare favorably.

The coefficients of transmission of the pitched roofs in Table 11-A apply where the roof is over a heated attic or top floor, such that the heat passes directly through the roof structure including whatever finish, if any, is applied to the underside of the roof rafters. By a heated attic is meant an attic to which heat is supplied directly from the furnace or boiler by means of radiators, hot air registers, or other means.

*Building paper is used because of its value as a wind stop only.

If the attic is unheated, the roof structure and ceiling of the top floor must both be taken into consideration and the combined coefficient of transmission determined. The formula for calculating the combined coefficient of transmission of a top floor ceiling, unheated attic space and pitched roof, *per square foot of roof area*, is as follows:

$$U = \frac{U_r \times U_{ce}}{n \times U_r + U_{ce}}$$

where

U_r = Coefficient of transmission of the roof. (From Table 11-A, Pitched Roofs).
U_{ce} = Coefficient of transmission of the ceiling. (From Table 9).
n = The ratio of the area of the roof to the area of the ceiling.

The following example will illustrate the use of this formula: Determine the combined coefficient of transmission of a roof constructed of wood shingles applied over wood strips on rafters, an unheated attic, and a wood lath and plaster ceiling, based on a roof having a ⅓ pitch, for which the value of n is 1.2 (Roof No. 251a).

U_r = 0.483 (Roof No. 238-a, Table 11-A)
U_{ce} = 0.502 (Ceiling No. 167-a, Table 9-A)

Substituting these values in the preceding formula:

$$U = \frac{0.483 \times 0.502}{1.2 \times 0.483 + 0.502}$$

= 0.224 B.t.u. per hour, per sq. ft. of roof area per 1 deg. fahr. *difference in temperature between the air near the underside of the ceiling and the outside air.*

Combined coefficients for many common types of pitched roofs and top floor ceilings for unheated attics are given in Table 11-B. If a roof contains two or more dormers and the attic is unheated, it is advisable to disregard the roof structure proper and consider only the top floor ceiling in determining the radiation requirements of the building. In this case it will be necessary to assume the temperature in the attic, which can be taken to be the mean between the temperature under the top floor ceiling (not the attic) and the outside temperature.

AREAS WHERE HEAT LOSSES OCCUR

Heat is lost from a building by transmission through all of those surfaces which separate heated spaces from the outside air or from unheated colder spaces within the building. In general, five kinds of surfaces are involved: (1) outside walls, (2) outside glass, (3) inside walls or parti-