are given in Table 5. As in the case of the examples in Fig. 3, the average value of 1.34 given in Table 4 for K_1 was used for all surfaces in still air. The value of K_2 for outside wall and roof surfaces was taken as $3 \times K_1$, or 4.02, corresponding to a wind velocity of approximately 15 miles per hour.

A value of $C = 8.3$ for stone concrete (1- 2- 4 mix) was used for computing the values of U for all constructions involving this material. It is quite probable that the true conductivity of stone concrete approaches the value of 6.3 obtained from tests conducted by Professor Peebles of Armour Institute, when the concrete is thoroughly dry and well cured. If, for a certain concrete construction, it appears that the value of 6.3 is more nearly correct, the engineer may at his discretion compute the value of U on the basis of this figure. This of course is true of other constructions.

The Research Laboratory of the American Society of Heating and Ventilating Engineers has developed an apparatus known as the Nicholls heat meter for the determination of the heat loss through any type of construction, and by means of which the value of U for any construction may be ascertained by actual test. The Nicholls heat meter consists essentially of a plate of bakelite, 2 ft. square and ⅛ in. thick. This plate is equipped with thermocouples which are so constructed as to operate as differential pyrometers. A difference in temperature between the two surfaces of the plate produces a difference in electrical potential between the thermocouples.

The plate is calibrated so that this difference in potential, when measured, can be converted into terms of heat transmission through the plate. In connection with this plate, it is also necessary to use several other thermocouples to give the temperature of the air within the building temperature of the interior surface of the wall or roof, the temperature of the plate itself, the temperature of the exterior of the wall or roof and the temperature of the exterior air.

Tests have been conducted at the Research Laboratory of the Society with the Nicholls heat meter on certain types of wall construction, and the results obtained are in close agreement with the computed values for these same constructions.

It would be obviously impossible to determine the air to air heat transmission coefficients of every type of wall construction in use with the heat meter on account of the great amount of time involved. Hence, the method of computing the coefficients from fundamental conductivity constants must be resorted to in most cases, but the heat meter can be used to good advantage in checking the accuracy of the computed values. The Society's Laboratory will continue its investigations of the air-to-air transmission coefficients of many common types of wall constructions in order to definitely establish the accuracy of as many of the computed values as possible.

Problems involving the determination of the value of U from the conductivity constants can also be solved by what is sometimes known as the resistance method which is readily derived from the basic equation No. 5 as follows:

$$\frac{1}{U} = \frac{1}{K} + \frac{1}{K} + \frac{x}{C} = \Sigma \left[R_1 + R_2 + R_c\right]$$

Table 5. Internal Conductivities of Building Materials and Insulations[1]

Note.—The internal conductivities in this table are expressed in B.t.u. per hour, per square foot, per 1 deg. fahr., per 1 in. thickness unless otherwise stated

A. Building Materials

Material	Description	Density (Lb. per Cu. Ft.)	Mean Temp. of Sample (Deg. Fahr.)	Internal Conductivity (C or C_u)	Authority[14]
Asbestos	Sheet	48.3	110	0.29	Willard, Lichty & Harding
Asbestos Board	Corrugated	20.4	110	0.48	Willard, Lichty & Harding
Asbestos Wood	Asbestos and cement compressed.	123.0	86	2.70	Bureau of Standards
Asbestos Mill Bd.	Pressed Asbestos	60.5	86	0.843	Bureau of Standards
Asbestos Shingles		65.0	75	6.00[2]	Peebles, Armour Institute
Asphalt Shingles		70.0	75	6.50[2]	Peebles, Armour Institute
Brickwork	Mortar Bond and dry conditions.	132.0	100	4.00	Willard, Lichty & Harding
Brickwork	Damp or wet			5.00	Recommended by Harding & Willard[12]
Cement Mortar				8.00[7]	Willard, Lichty & Harding
Concrete	Stone 1-2-4 mix	140.0	110	8.30	Willard, Lichty & Harding
Concrete	Stone	145.0	75	6.30	Peebles, Armour Institute
Concrete	Stone 1-2-5 mix		95[3]	6.27	C.L. Norton, Boston, Mass.
Concrete	Cinder 1-2-4 mix		122	2.35	C.L. Norton, Boston, Mass.
Concrete	Cinder	110.0	75	5.20	Peebles, Armour Institute
Concrete Blocks	Stone Dry	103.6	68	4.84	Hencky
Cornell Wood Board	Ground Wood pulp (⅜″ thick).		75	2.50[2]	Peebles, Armour Institute
Gyplap	Gypsum between layers of heavy paper (½″ thick)	53.5	90	2.60[2]	Bureau of Standards
Gypsum	Building—oven dried 3 weeks.	78.0	68	2.99	Poensgen
Gypsum	Building—mixed with 15 per cent wood fiber.			2.30	Calculated[9]
Gypsum Partition Tile.	Hollow		75	1.00	Peebles, Armour Institute
Gypsum Roof Tile	Reinforced		75	1.20	Peebles, Armour Institute
2 in. Hollow Clay Tile, ½ in. plaster both sides		120.0	110	1.00[2]	Willard, Lichty & Harding
4 in. Hollow Clay Tile, ½ in. plaster both sides		127.0	100	0.60[2]	Willard, Lichty & Harding
6 in. Hollow Clay Tile, ½ in. plaster both sides		124.3	105	0.47[2]	Willard, Lichty & Harding
2 in. Hollow Clay Tile				1.14[2]	Calculated[4]

[1]See Chapter LX, by Chas. H. Herter of the Report of the Insulation Committee, *A.S.R.E.*, Annual Meeting 1922, Revised to 1924, entitled "Heat Transmission of Insulating Materials" for a more comprehensive collection of heat transmission data relating to building and insulating materials.

[2]For thickness stated or used in construction, not per 1 in. thickness.

[3]Hot side of plate.

[4]Estimated from values reported in University of Illinois Engineering Station, Bulletin No. 102, for hollow clay tile plastered both sides, assuming the conductivity of cement plaster = 8.0 per 1 in. thickness.

[5]Calculated from 2 in. tile tests.

[6]Average of several values.

[7]Cement mortar and stucco assumed same as cement plaster.

[8]Roofing, 0.15 in. thick (1.34 lb. per sq. ft.), covered with gravel (0.83 lb. per sq. ft.), combined thickness assumed 0.25.

[9]Estimated from value of $C = 2.99$ for gypsum and $c = 1.0$ for wood.

[10]Not compressed.

[11]The conductivity of plaster varies with the composition. Note range of values from 2.32 to 8.0. The average value for plaster is probably about 5.0. On account of the comparatively high conductivity of plaster and the fact that it is seldom applied more than ¾ in. thick, this material does not appreciably effect the overall transmission of a construction, excepting in the case of thin uninsulated walls.

[12]See "Mechanical Equipment of Buildings" by Harding and Willard, page 56.

[13]Thickness of lime plaster and wood lath from back of lath to face of plaster, about ⅝ in.

[14]In addition to the conductivity values for the authorities listed, considerable work of importance pertaining to the heat transmission of various types of construction and materials has been done by the late Prof. John R. Allen and Prof. F. B. Rowley of the Engineering Experiment Station of the University of Minnesota, and Prof. A. J. Wood of the Engineering Experiment Station of Pennsylvania State College.