p = percentage of free area of grille expressed as a decimal.
C = a coefficient that varies with the velocity from grille and may vary slightly with type of grille. (See Table 4).

As the velocity increases, C approaches a constant value, and the highest value shown can be used for all higher velocities with very slight error.

Particular care should be exercised in the case of long, narrow grilles. The nature of the approach sometimes results in a narrow strip along the top or bottom of the grille through which no air will be flowing. This may be detected by holding the anemometer completely out of the air stream and then moving it slowly inward over the grille until the vanes just start to move. The distance which the vanes extend over the grille opening at this moment will indicate the width of the dead strip. Only

TABLE 4. VALUES OF C FOR VARIOUS AIR VELOCITIES[a]

AVERAGE INDICATED VELOCITY, *fpm*	SUPPLY GRILLES
150	0.952
200	0.957
300	0.967
400	0.977
500	0.985
600	0.992
700	0.998
800	1.000
Factors for average use: low velocity	0.97
Factors for average use: high velocity	1.00

[a]These coefficients refer to thin lattice work grilles without louvers or dampers.

the remaining portion of the grille should be considered in making the calculations for gross and free area.

Care should also be taken to use the correct free area of the grille, as this is equally as important as the air measurement. The results of tests on grilles of ornamental plaster design are not in as close agreement as those given in Table 4 for thin lattice work grilles without louvers or dampers. It is difficult to measure the free area of ornamental grilles, because the material is much thicker, and since parts of the surface are raised above the general level it is difficult to keep the anemometer in contact. Until tests now under way afford some improved method, the use of an anemometer with ornamental plaster grilles for measurement of air supply is not recommended.

Exhaust Grilles. The surface of the grille should be marked off and readings taken in the same manner as with supply grilles, except that the instrument should be held with the dial facing the grille, and in contact with it. The traverse should be taken at a uniform rate, allowing sufficient time in each space to minimize the percentage of error. In the case of exhaust grilles it is found that the formula

$$cfm = KVA \quad (8)$$

gives more accurate results, *in which*

V = average indicated velocity obtained by the anemometer traverse in contact with grille.
A = gross area of grille, square feet.
K = coefficient determined by experiment.

The value of K in Formula 8 ranges from 0.8 for cast-iron plain lattice design exhaust grilles at a velocity of 150 fpm to 0.82 at 700 fpm. For thin iron grilles of conventional ornamental design, the value of K varies from 0.75 at 150 fpm to 0.834 at 700 fpm. The use of a constant 0.8 would therefore introduce an error which is very slight. It has also been found in the experiments at *Armour Institute of Technology* that tests of exhaust grilles of ornamental plaster design are in much closer agreement than is the case with supply grilles, and the use of the same formula recommended for exhaust grilles of plain lattice design will give results which, while not so accurate, are subject to errors varying from + 11 per cent to − 7 per cent. Formula 8 has the advantage of making it unnecessary to measure the free area, which in the case of grilles of ornamental design is difficult to do.

The flow of air through registers and grilles is of considerable importance, being frequently the only convenient method of measuring the volume of supply air to a room. While duct measurements, if available, are more dependable, grille measurements provide a fairly accurate method, if care is taken in the technique of using the anemometer.

Kata-Thermometer

The Kata-thermometer which was invented by Dr. Leonard Hill of England, can be used advantageously as an anemometer provided the walls and surrounding objects are at or near the room temperature. Especially at low velocities it constitutes a useful instrument for readily detecting drafts.

The instrument is essentially an alcohol thermometer with a bulb approximately ⅝ in. in diameter and ½ in. long with a stem 8 in. long reading from 100 to 95 F, graduated to tenths of a degree. To take readings the bulb is heated in water until the alcohol expands and rises into the top reservoir. It is then thoroughly dried and all traces of moisture are removed. The time in seconds required for the liquid to fall from 100 F to 95 F is recorded with a stop watch and this time is a measure of the rate of cooling.

The dry Kata gives the cooling power by radiation and convection. The wet Kata, which has a cotton lisle wick fitted snugly around the bulb, gives the cooling power by radiation, convection and evaporation. For constant velocities the time of cooling of the dry Kata is a function of the dry-bulb temperature alone, while that of the wet Kata is a function of the wet-bulb temperature regardless of the dry-bulb temperature or the relative humidity.

Due to the comparatively brief time of fall of the wet Kata thermometer, the dry Kata thermometer is far more accurate for measuring air