The resultant room noise level can be approximated by Equation 10.

$$\text{Room Level} = \left[\begin{matrix}\text{Noise Level at Face} \\ \text{of Grille}\end{matrix}\right] - 10 \log_{10} \frac{\text{Total Room Absorption in Sabines}}{\text{Total Grille Area}} \quad (10)$$

Grille Selection

In practice the allowable total sound and the required air flow are usually known, and it is desired to determine the maximum allowable velocity. In comparing sound ratings of various grilles several factors must be known if the information is to be properly applied:

1. The threshold intensity on which the decibel ratings are based.
2. The distance from the grille at which data were taken.
3. If stated as loudness level versus velocity for a given grille, the *core area* (not nominal area) must be known.
4. The sound absorbing characteristics of the test room.
5. Whether or not corrected for test room loudness level: if not, the room level (without grille noise) must be known.
6. Methods used for recording data. (Characteristics of sound meter).

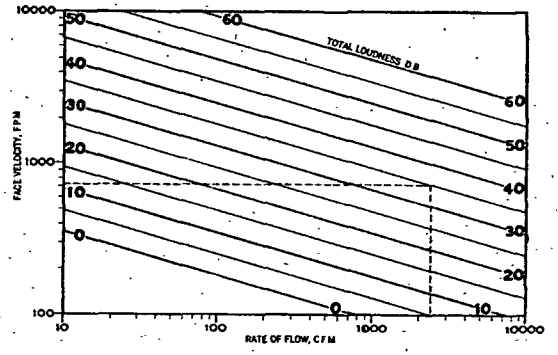

FIG. 5. AIR FLOW AND LOUDNESS CHART

Since total loudness and air flow are both functions of velocity and area, the solution of the problem implies a trial and error method. It has been found possible to present these data with sufficient practical accuracy as a family of uniform curves, as illustrated in Fig. 5, which are based on these assumptions:

1. Threshold intensity = 10^{-16} watts per square centimeter[9].
2. Microphone location 5 ft from lower edge of supply opening on a line downward at 45 deg and in a plane bisecting the supply opening perpendicularly.
3. Where data are given as loudness level versus velocity, the rating is per square foot of core area.
4. The room is assumed to have 100 sabines absorption.
5. Plotted data are loudness levels of *supply openings only*, correction having been made for test room level.
6. Data taken with a direct reading sound-level meter with frequency weighing network intended to approximate the response of the human ear.

If the published ratings are in terms of decibels per square foot, correction must be made for area to secure the total sound level of supply openings of more or less than one square foot area from Equation 11.

$$\text{Decibel Addition} = 10 \log_{10} A \quad (11)$$

where

A = core area, square feet.

[9]Loc. Cit. Note 1.

With Fig. 5 it is possible to find directly the velocity in feet per minute which will give a predetermined total loudness at a predetermined rate of flow expressed in cubic feet per minute. The values used are arbitrarily chosen for the purpose of discussion and do not necessarily represent data

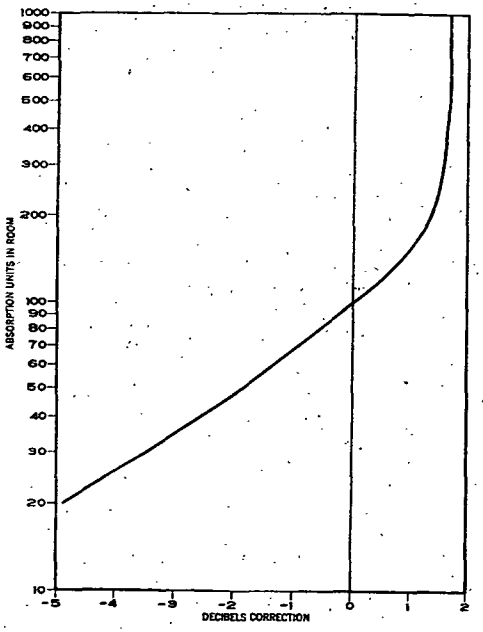

FIG. 6. ROOM ABSORPTION CORRECTION CHART

referring to any particular design of air supply opening. A correction chart is shown in Fig. 6 for a room having a sound absorption other than 100 sabines.

Example 3. Determine the core area (see Chapter 30) of an air supply grille which will maintain a noise level of not more than 40 db in a room having 100 sabines of sound absorption, if an air volume of 2400 cfm is required to maintain the proper air conditioning.

Solution. Assuming a grille noise rating of at least 5 db below the noise level of the room, Fig. 5 shows that the limiting grille velocity for a total loudness of 35 db is about 725 fpm and the core area becomes fixed at 2400 ÷ 725 or 3.31 sq ft.

If the room absorption had been greater, the previously selected velocity of 725 fpm would be safe, since the loudness reduces. If the room absorption had been 200 sabines a correction of plus 1.3 should be made by reference to Fig. 6, and the permissible velocity becomes that corresponding to a total loudness of 36.3 or approximately 800 fpm.

If the room had been highly reflective with an absorption of less than 100, the correction would be much more important. For instance, for a room of 35 sabines a correction of minus 3 db should be made and the maximum velocity corresponding to the 32 db total loudness would be approximately 600 fpm.