Data mentioned in this chapter are based on these assumptions:

1. Threshold intensity = 10^{-16} watts per square centimeter[4].
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 sabins 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

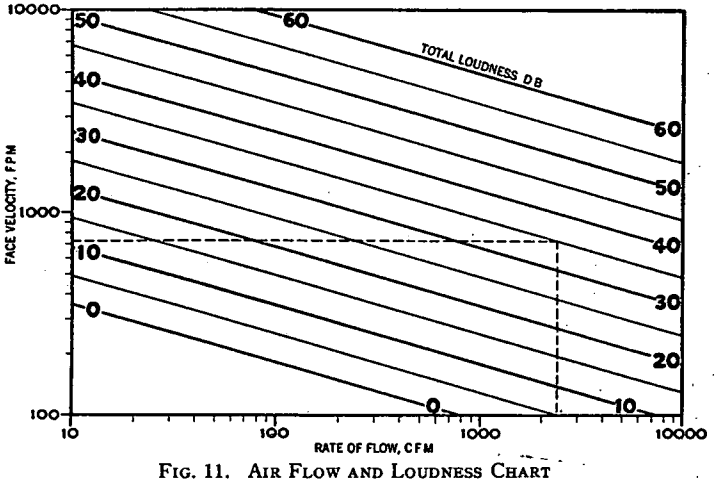

FIG. 11. AIR FLOW AND LOUDNESS CHART

openings of more or less than one square foot area from Equation 2.

$$\text{Decibel Addition} = 10 \log_{10} A \qquad (2)$$

where

A = core area, square feet.

In practice the allowable total sound and the required air flow are usually known, and it is desired to determine the maximum allowable velocity. Since total loudness and air flow are both functions of velocity and area, the solution of the problem by use of the previous analysis 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. 11. With this chart 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

[4]American Tentative Standards for Noise Measurement, *American Standards Association.*

values used are arbitrarily chosen for the purpose of discussion and do not necessarily represent data referring to any particular design of air supply opening. It is assumed that Fig. 11 is based on a room having 100 sabins of sound absorption. In such a room the sound level due to other sources may be 40 db. As previously stated a supply opening having a noise level of 35 db would be substantially inaudible in such a room.

If 2400 cfm are required with a total noise due to supply opening of 35 db, a velocity (Fig. 11) of about 725 fpm may be used. From this velocity and the rate of flow, the core area can be computed. This determination was on the basis of a room absorption of 100 sabins. If

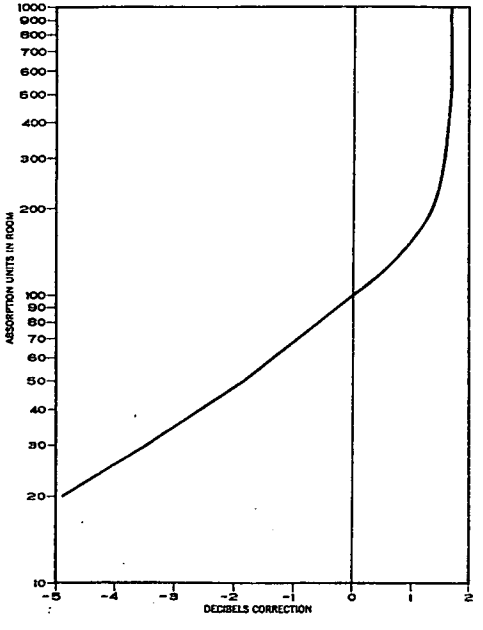

FIG. 12. ROOM ABSORPTION CORRECTION CHART

the absorption is greater, the 725 fpm velocity is safe, since the loudness level will go down. However, correction can be made if desired by the use of the chart of Fig. 12. Thus, if the absorption is 200 sabins, a correction of +1.3 db may be made and the permissible velocity becomes that corresponding to a total loudness level of 36.3 db or approximately 800 fpm. If the room is highly reflecting and has an absorption of less than 100, correction is much more important. For instance, for 35 sabins a correction of −3 db must be made and the maximum velocity corresponding to 32 db total loudness chosen is approximately 600 fpm.

Where more than one supply opening must be considered, the problem is more complicated. If a similar supply opening is added in a far corner of a highly absorbent room, the change in noise level at the 5-ft station at the first supply opening is small; however, if the room is small, or highly