there is one basic law which is important in the solution of the problem. That is the law of transmissibility as governed by the equation:

$$T = \frac{1}{1 - \left(\frac{w}{w_n}\right)^2} \tag{13}$$

where

T = transmissibility of the support.
w = frequency of the vibratory force.
w_n = natural frequency of the machine unit on its support (Damping = 0).

Equation 13 shows that the transmissibility approaches unity for disturbing frequencies considerably lower than the natural frequency of the mounting. As the disturbing frequency is increased the transmissibility is also increased until at the resonant frequency, where $w = w_n$ the transmissibility becomes infinite. This is not true in practice because all materials have some internal damping effect. However, operating at or very close to the resonant frequency is always serious as forces and stresses may be multiplied 10 to 100 times. As the disturbing frequency becomes greater than the natural frequency the transmissibility becomes a smaller quantity and at the value of $w/w_n = \sqrt{2}$ it again has the value of unity. Beyond this point true isolation is first accomplished. At a ratio of 3 to 1 for w to w_n the isolation is effective enough for practical application, and experience and economical design has shown that a ratio of 5 to 1 is good. For high speeds, higher ratios for w to w_n are easily attained and give better results for effective vibration control but for the lower speeds as experienced with compressor work the higher ratios become uneconomical.

For a given installation the speed of the compressor is fixed by the specifications, therefore the value of w is fixed. That leaves only w_n to be determined and that is accomplished by the choice of mounting material and design for the support of the machine. It is well to keep in mind that when trying to isolate vibration, no attempt should be made to isolate the driving and driven piece of equipment separately. The two should be mounted on a rigid frame and then the entire assembly isolated according to the rules presented in this chapter.

The value of w_n can be controlled by the flexibility of the machine support, and when the deflection of the machine support is proportional to the load applied (such as springs or nearly so with rubber in shear) the value of w_n can be determined by Equation 14.

$$w_n = \sqrt{\frac{g}{d}} \tag{14}$$

where

g = gravitational constant.
d = static deflection of supporting material.
w = radiams per second and may be converted to frequency (f) expressed in cycles per second by Equation 15.

$$f = \frac{w}{2} = \frac{1}{2}\sqrt{\frac{g}{d}} \tag{15}$$

By the use of Equation 14 a set of curves may be plotted as shown in Fig. 7. The first line AB plotted as the critical frequencies for the various static deflections, is a curve showing the worst possible conditions or resonant conditions.

Plotting another curve CD, which is $\sqrt{2}$ times curve AB, shows the area $MCDN$ in which the resilient material or mounting does more harm than good. Plotting two more curves EF, 3 times curve AB, and GH, 5 times curve AB, shows area $EGHF$ which represents efficient and economical isolation. Area $GPOH$ is excellent isolation but for all except the

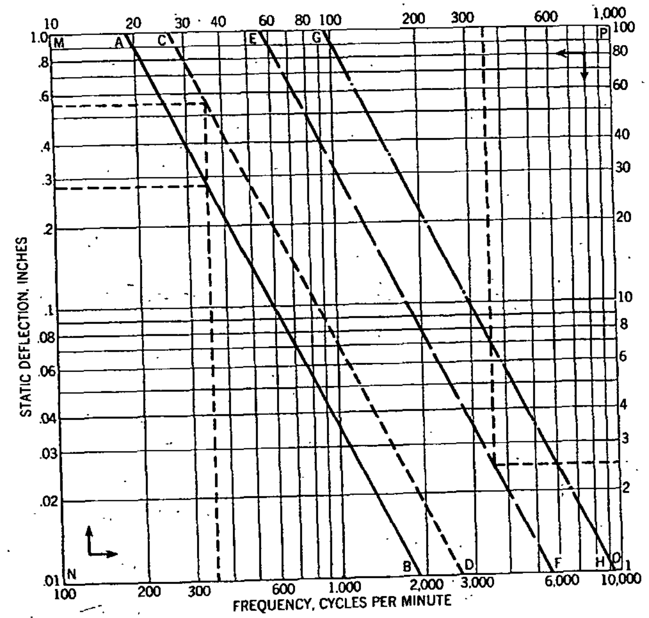

Fig. 7. Static Deflection for Various Frequencies

highest speeds becomes rather uneconomical because of the large deflections required.

Example 3. An electric motor driven compressor unit is to be isolated. The compressor is partially balanced and operates at a speed of 360 rpm. The speed of the motor is 1160 rpm and is belt connected to the compressor. Total weight of the compressor and motor is 4500 lb.

Solution: The minimum disturbing frequency to be isolated is 360 cycles per minute. Assume that the desired ratio of forced to natural frequency is 3 as a minimum and that 5 is desired. The desired natural frequency of the mounting is 360 ÷ 5 = 72 cycles per minute.

From Fig. 7 a deflection of 7 in. is required to attain a natural frequency of 72 cycles per minute. This value may be obtained from critical curve AB for 72 cycles or from curve GH (5 times critical) for 360 cycles. For the minimum ratio of 3 the deflection would be 2.5 in.

The next step is to determine the total weight to be supported by the springs. For