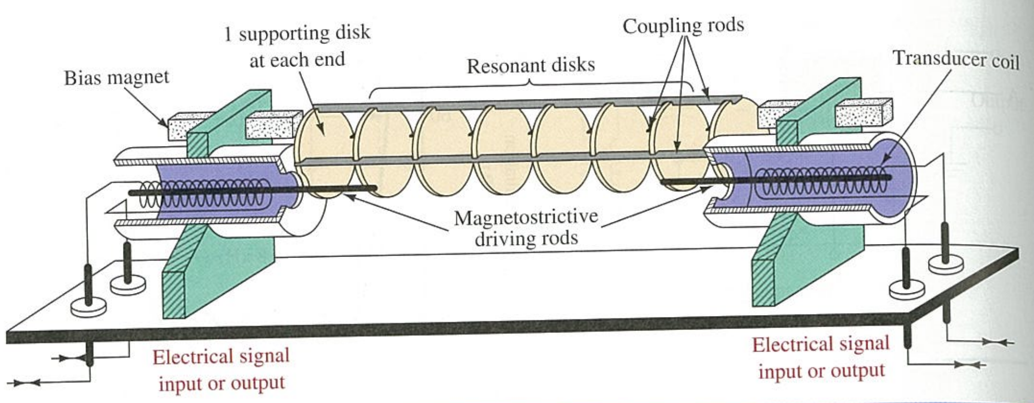

FIGURE 4-6 Mechanical filter.

Figure 4-7 is the electrical equivalent of the mechanical filter. The disks of the mechanical filter are represented by the series resonant circuits L_1C_1 while C_2 represents the coupling rods. The resistance R in both the input and output represents the matching mechanical loads. Phase shift of the input signal is introduced by the L and C components of the mechanical filter. For digital applications, a phase shift can affect the quality of the digital pulse. This can lead to an increase in data errors or bit errors. In analog systems, the voice transmission is not affected as much because the ear is very forgiving of distortion.

Let us assume that the mechanical filter of Figure 4-6 has disks tuned to pass the frequencies of the desired sideband. The input to the filter contains both sidebands, and the transducer driving rod applies both sidebands to the first disk. The vibration of the disk will be greater at a frequency to which it is tuned (resonant frequency), which is the desired sideband, than at the undesired sideband frequency. The mechanical vibration of the first disk is transferred to the second disk, but a smaller percentage of the unwanted sideband frequency is transferred. Each time the vibrations are transferred from one disk to the next, there is a smaller amount of the unwanted sideband. At the end of the filter there is practically none of the undesired sideband left. The desired sideband frequencies are taken off the transducer coil at the output end of the filter.

Varying the size of C_2 in the electrical equivalent circuit in Figure 4-7 varies the bandwidth of the filter. Similarly, by varying the mechanical coupling between the disks (Figure 4-6), that is, by making the coupling rods either larger or smaller,

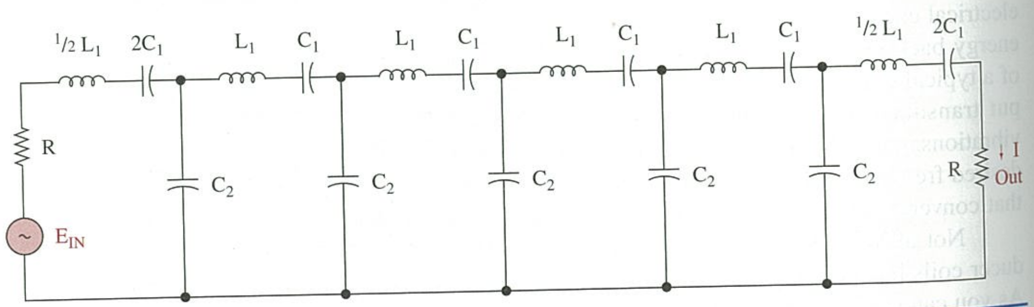

FIGURE 4-7 Electrical analogy of a mechanical filter.

the bandwidth of the mechanical filter is varied. Because the bandwidth varies approximately as the total cross-sectional area of the coupling rods, the bandwidth of the mechanical filter can be increased by using either larger coupling rods or more coupling rods. Mechanical filters with bandwidths as narrow as 500 Hz and as wide as 35 kHz are practical in the range 100 to 500 kHz.

4-4 SSB TRANSMITTERS

Filter Method

Figure 4-8 is a block diagram of a modern single-sideband transmitter using a balanced modulator to generate DSB and the filter method of eliminating one of the sidebands. For illustrative purposes, a single-tone 2000-Hz intelligence signal is used, but it is normally a complex intelligence signal, such as that produced by the human voice.

A 9-MHz crystal frequency is used because of the excellent operating characteristics of monolithic filters at that frequency. The 2-kHz signal is amplified and mixed with a 9-MHz carrier (**conversion frequency**) in the balanced modulator. Remember, neither the carrier nor audio frequencies appear in the output of the balanced modulator; the sum and difference frequencies (9 MHz ± 2 kHz) are its output. As illustrated in Figure 4-8, the two sidebands from the balanced modulator are applied to the filter. Only the desired upper sideband is passed. The dashed lines show that the carrier and lower sideband have been removed.

Conversion Frequency
another name for the carrier in a balanced modulator

The output of the first balanced modulator is filtered and mixed again with a new conversion frequency to adjust the output to the desired transmitter frequency.

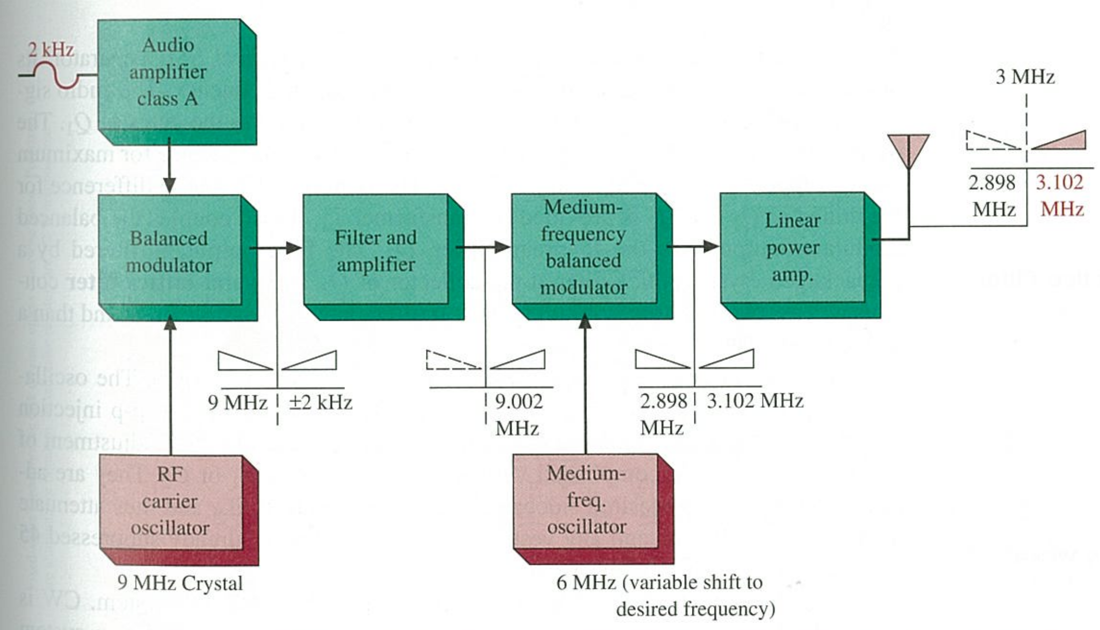

FIGURE 4-8 SSB transmitter block diagram.