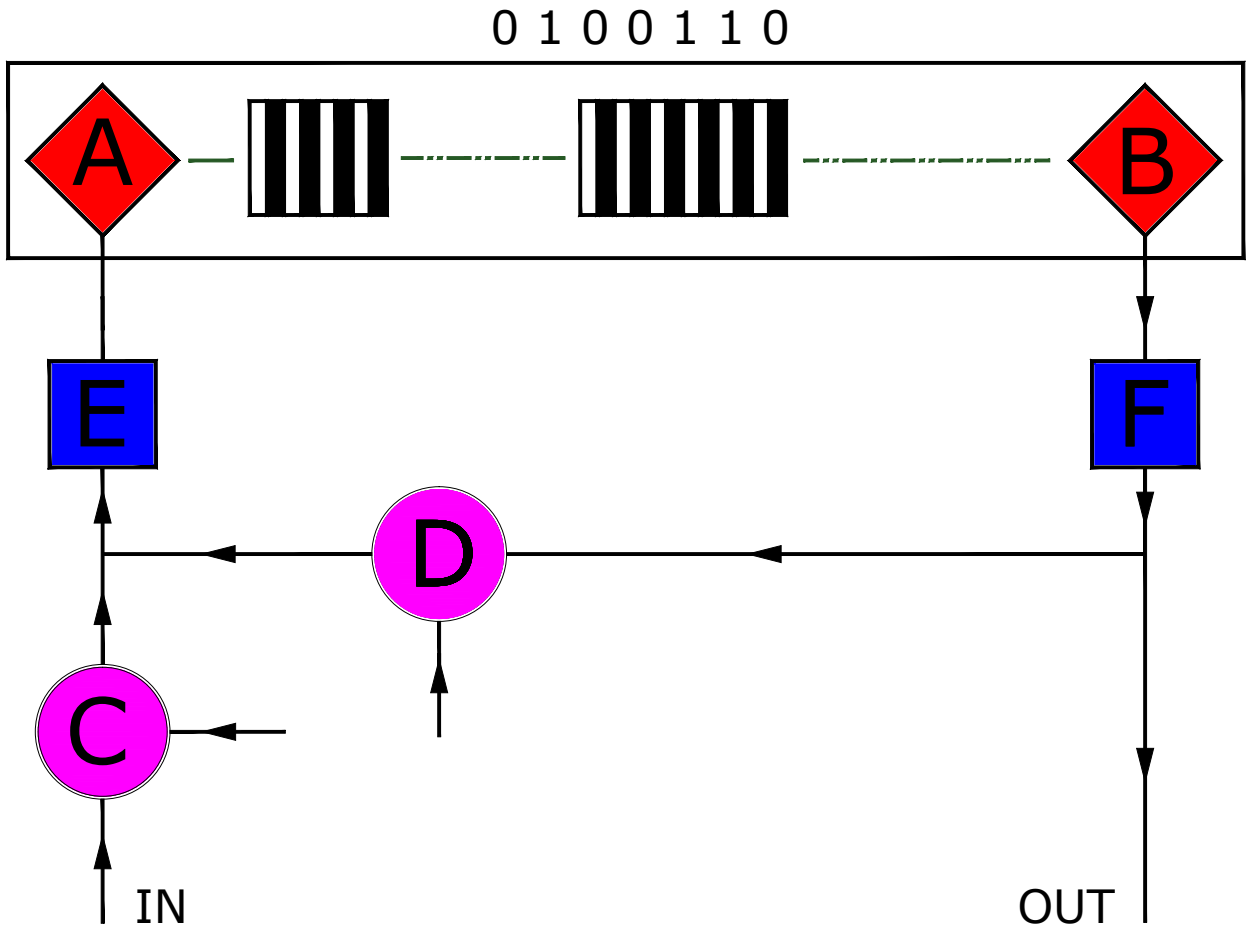
Acoustic Delay Line Memory

Calculators require large stores, to accept information from the pulses of electron movement and keep it until some other pulse is sent with the object of modifying it, or reading what is there. Massive storage is not unusual nowadays, and even the early computers were capable of such a capacity, but expense became the limiting factor. Bistable circuits were not nearly cheap enough, and something easier to make was needed. One method, was to use the properties of sound waves. It is well known that sound waves travel through solids, liquids, or gases, by virtue of the elasticity of the medium. Solids also have a second form of elasticity when in torsion. if a small but sharp twist is given to one end of a long rod, the twist travels rapidly at constant speed right along the rod, to be reflected back from the far end. Both forms of elasticity are used to store many bits of information, with the help of electronics for pulse regeneration, and the device is called a Delay Line. A sequence of, say, 10 waves, to represent one bit, can be fed into one end of these delay lines, through a transducer, by piezoelectric strain of a quartz crystal in the first case and by magnetostriction in the second. The diagram below shows the transmission of part of a binary number along a Delay Line. A sequence of 10 compressions and rarefactions (carrier waves) generated at transducer A represents the digit 1 if present and 0 if absent. (A completely undisturbed delay line contains a string of 0's, the number depending on the reading equipment used.) Each sequence, of duration 0.67 microsecond, reaches the other end of the line about 1000 microseconds later, but the carrier waves will have lost some of their regularity. However, each sequence can be read -that is converted back into an electrical pulse- by a device B, exactly like the input transducer A, and then with units F and E it is not difficult to regenerate electronically a perfect sequence of carrier waves and reinsert them at the input end. So the information goes around and around, in one direction with the speed of sound, and back again with the speed of light. Delay lines were used as medium-sized, rather fast stores in earlier computers and calculators, and they had the virtue that any part of the information, even a single bit, could be changed by applying a suitable pulse or nonpulse at the appropriate instant at the input end, using the switch controls C and D in the diagram.



(Source: Information Retrieval, The Essential Technology)