

## Simple telephone circuits beginning design evolution variations

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One of the most successful technical inventions of relatively recent times was the [telephone](#). Prior to that, the telegraph was the only way to move information relatively fast. Faster than smoke signals or drum beats anyway. Many children know it for a long time that connecting two empty tin containers with a string would make a passable telephone **Figure 1**. Old ships used to be outfitted with lovely copper or brass piping to serve channeling the sound waves from the bridge to the engine room and to possible other places as needed.



**Figure 1.** String Phone

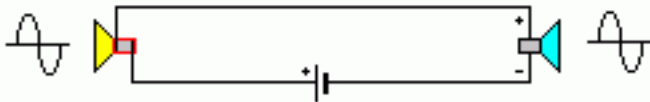
Sound waves travel a long way in the air, but as the distance increases, the wave intensity (sound pressure) decreases with the square of the distance. If the sound is confined and forced to move in a closed pipe, it can travel longer distances. Interestingly - to my knowledge - there

was never any piped telephone service between villages or cities. Perhaps the ancients had problem producing enough pipes. We know that the Romans made lots of lead pipes and used them as underground conduit for their aqueducts when a deep valley was in their way.

For a sound to move longer distances, the sound wave needed to be converted to another type. **Figure 2** shows a simplified, but usable form of the Bell telephone. Actually the original Bell telephone as invented used two headphone pieces connected together with a length of wire. Our circuit uses two identical [speakers](#) to achieve similar results. The sound moves the membrane of the speaker and when the attached voice coil moves in the surrounding magnetic field induces electrical voltages. The voltages travel along the wires to the other speaker and the fluctuating voltage moves the membrane thus reproducing the first speaker membrane's movements. This type of telephone is useable for longer distances, but after awhile the voice gets too low.



**Figure 2.** Two Headset Bell Telephone



**Figure 3.** Carbon Microphone Telephone

**Figure 3** shows a similar arrangement to Figure 2. The major difference that the left side speaker is changed to a carbon microphone and a voltage source is added to the circuit. When a sound wave moves the diaphragm of the microphone, the pressure change compresses the carbon granules within. As the carbon gets more or less pressure, their resistance varies accordingly. The resulting varied current moves the speaker's voice coil. There is amplification in that circuit resulting in clearer, stronger sound that can be carry to longer distances. The amount of amplification is a function of the microphone, the voltage of the battery and the resistance and construction of the speaker.

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