

# **BASIC ELEMENTS AND COMPONENTS OF AN AMPLIFIER**

## **Basic Elements of an Amplifier**

Though the basic explanation of an amplifier was explained above, the making of it is far more complex. We know that there are two signals generated during the process. They are the input signal and the output signal. The input signal is completely different from the output signal. Thus we can consider the generation of these signals as two separate electronic circuits. The input signal circuit is the signal recorded in a tape. It is designed as to modify the output signal circuit with its load. This is done by changing the resistance to the output circuit so as to make new voltage fluctuations of the original sound signal. But this load is very high when compared to the original sound. So, the sound must be first boosted with the help of a pre-amplifier. This will help in making a much more strong output signal as the input to the power amplifier. There is no much difference in the working of pre-amplifier compared to amplifier. A change in resistance is given by the input circuit to the output circuit, through the power supply. The design and number of pre-amplifiers in an amplifier varies according to the manufacturer.

The output circuit is generated by the power supply of the amplifier. The power supply helps in drawing the required energy from an external battery or power outlet.

Mostly the main power supply will be in ac form. It will be changed to dc and then given to the amplifier. The power supply also helps in making an uninterrupted signal by making the current smoother. This load will then be given to the cone of the speaker.

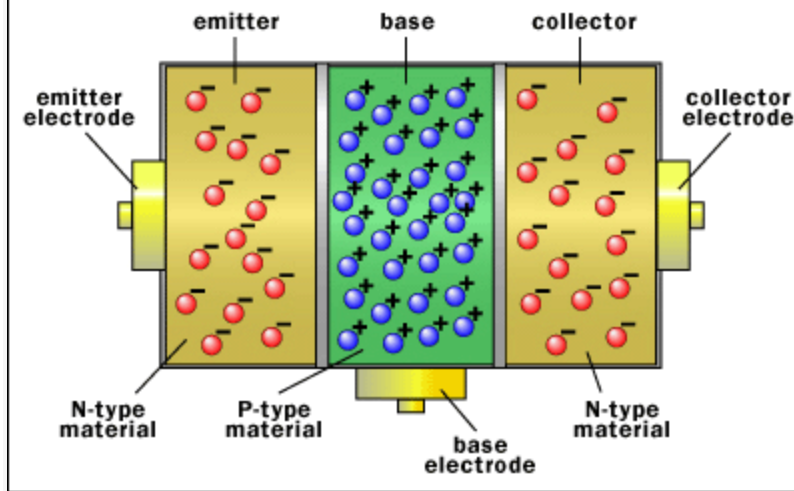
For all this to work together a combination of many electronic circuits will be needed. The designer has to make sure that each and every part of the audio signal is correctly represented.

## **Basic Components of an Amplifier**

One of the most basic components of an amplifier circuit is the transistor. The materials of the components used for an amplifier, must be able to conduct electric current in a varying manner. That is why the transistor is often used. The working of an N-P-N transistor is given below.

We know that N-type semiconductors carry electrons and P-type semiconductors carry holes. In an N-P-N transistor, the P-type semiconductor will be kept in between two N-type semiconductors. This is illustrated below.

## How Amplifiers Work



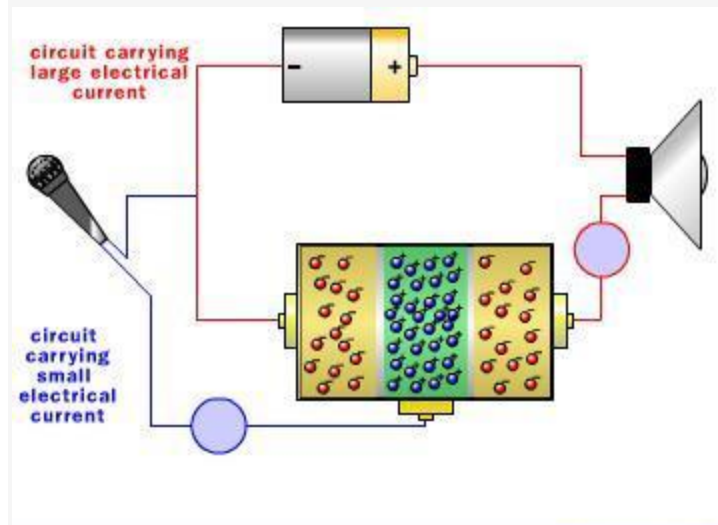
### Working of transistor in an Amplifier

From the left, the first N-type semiconductor is called the emitter. The middle P-type semiconductor is called the base and the end N-type semiconductor is called the collector. The output circuit which is supposed to drive the speaker is connected between the collector and the emitter ends. The input circuit will be connected between the emitter and the base terminals.

The N-type electrons and the P-type holes start to get attracted. But, the number of free electrons is way higher than the number of holes. This will result in the combination and the filling up of holes. As a result of this combination depletion holes will be created at the boundaries of the N-type and P-type. This will cause the semiconductor material to switch back to its insulating state. Thus the charges get accumulated with no other place to go. Thus the depletion zones get heavier. Thus the movement of charge from the emitter to the collector reduces, even if there is a huge difference in voltage between the two electrodes. This situation has to be overcome.

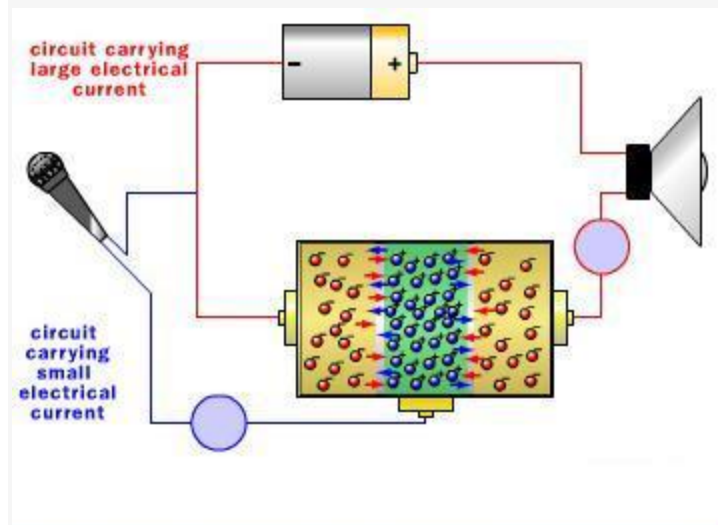
For the problem to be solved, a high voltage supply must be given to the base terminal. As the input current controls the base terminal its flow will cause the base terminal to have a higher positive charge and thus attracts the electrons from the emitter terminal. This in turn reduces some holes and thus reduces the size of the depletion region. This will help in an easier movement of the charges from the emitter to the collector. All these actions cause a natural increase in the conductivity of the transistor.

In short, the voltage given to the base terminal decides the amount of conductivity of the transistor and the size of the depletion region. Here is the diagram of the working of a transistor as an amplifier.



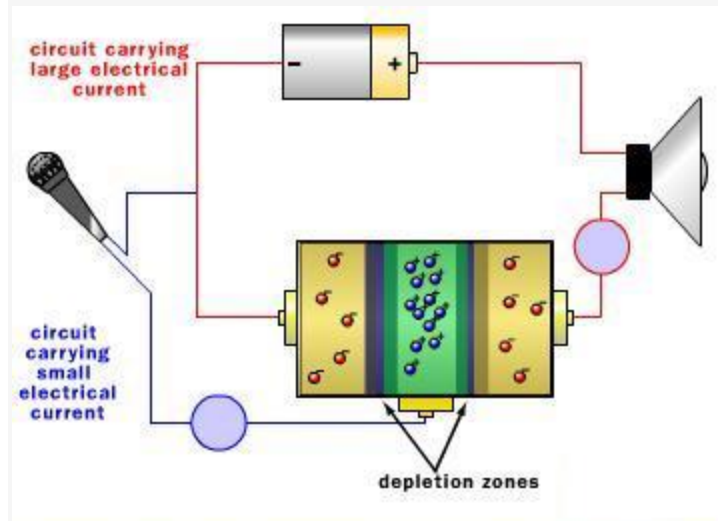
**1:**  
In this set-up, the amplifier's output circuit is connected to the emitter and the collector. The input circuit connects to the emitter and the base.

### Working of Amplifiers-Step 1



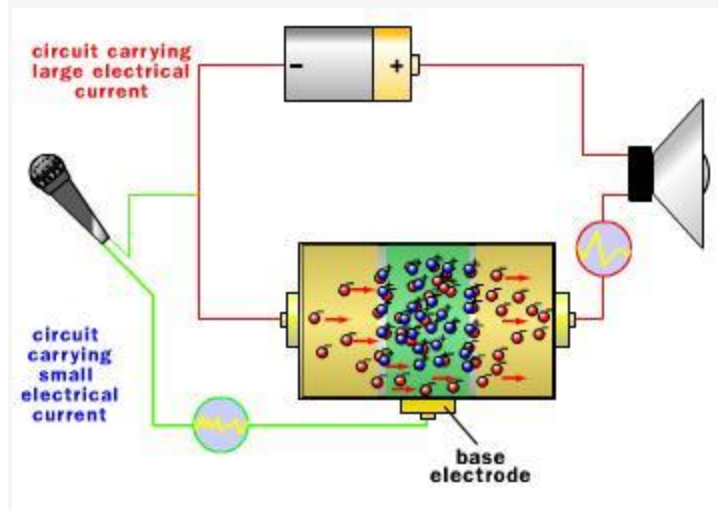
**2:**  
When no current flows through the input circuit, free electrons from the n-type material fill the available holes in the p-type material.

## Working of Amplifiers-Step 2



**3:** This creates depletion zones (areas where current can't flow easily) at the boundaries between the n-type layers and the p-type layer.

## Working of Amplifiers-Step 3



**4:** When current flows across the input circuit, it causes an extra voltage boost at the base electrode. This gets electrons moving again, shrinking the depletion zones. Electrical resistance drops, and electrons can move from the emitter to the collector again. In this way, the voltage at the base electrode determines the overall resistance of the transistor, and therefore the current in the output signal.

## Working of Amplifiers-Step 4

The above shown figure is just one stage of an amplifier. In order to get the sound signal boosted up in the form of an electrical signal, there has to be a lot more stages. Anyhow, the final stage of amplification will be the speaker driver.

The output power produced in an amplifier depends on the necessity of its use. If it is used in some huge hall, the amplifier must produce an output power of at least a thousand watts. On the other hand, if it is used in a home theatre stereo amplifier, it may just need a few hundreds of watts as the output power. If it is in a speaker phone, the output will be the least of half a watt.

Whatever the power may be, an amplifier must produce the least amount of distortion as possible. On the same time, the boosting of the sound must be high in the final driving stage and a high replica of the original sound must be produced. For these characteristics to occur accurately, the parameters like power rating, input impedance, output impedance and also fidelity must be varied accurately.

By the concept of amplifiers we always think of amplifying sound. But, the same process can be done for amplifying radio signals and video signals as well.

Source : <http://todayscircuits.blogspot.com/2011/06/working-of-amplifiers.html#.VUCGaNKqqko>