

Fact Sheet: Physics of Electrical Musical Instruments

1) Speakers:

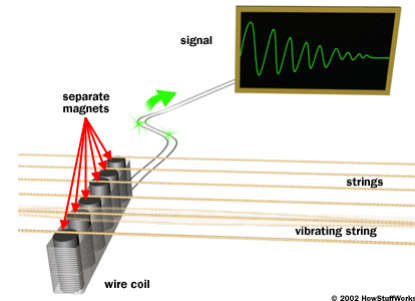
- ❖ A current induces movement in a solenoid & diaphragm, producing sound waves.

2) Microphones:

- ❖ Some are built similar to speakers: they can function as a speaker, and vice versa.
- ❖ More often, they contain a variable capacitor that fluctuates based on incoming sound waves and sends out a corresponding electric signal.

3) Electric Guitars

- ❖ Electric guitars use magnetic fields, and alternating currents to amplify sound.
- ❖ Guitar pickups create an AC which can be visualized as the electric representation of the vibrating string.
- ❖ Humbuckers have two coils that serve to eliminate ambient noise (electric field).

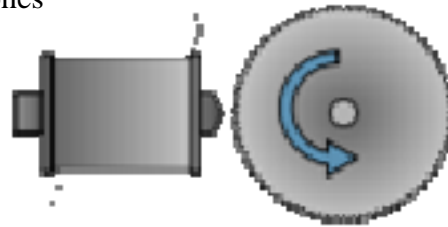


4) Amplifiers

- ❖ Most modern amplifiers are solid state: they use transistors as a means of amplification.
- ❖ Alternatively, tube amps use vacuum tubes, which utilize a voltage drop between its components to amplify current.

5) Electric Organs

- ❖ A sine tone is produced by notched gears spinning in front of a pickup.
- ❖ When a key is pressed, multiple sine tones (harmonics of the same fundamental frequency) are generated and combined to create various tones.



6) Theremins

- ❖ Are really cool.
- ❖ Operate on a principle of varying capacitance where the player's hand acts as a grounded plate.
- ❖ One constant frequency (far higher than audible range) combines with a varying frequency close to the constant which produces a beat frequency in an audible range.

7) Synthesizers

- ❖ A keyboard is a variable resistor. What key you hit determines the resistance, which determines the pitch.
- ❖ In an RC circuit, the variable resistor modifies the frequency.
- ❖ The oscillator is an LC circuit with a transistor as an amplifier.

8) Sound Demons

- ❖ Terrify you.