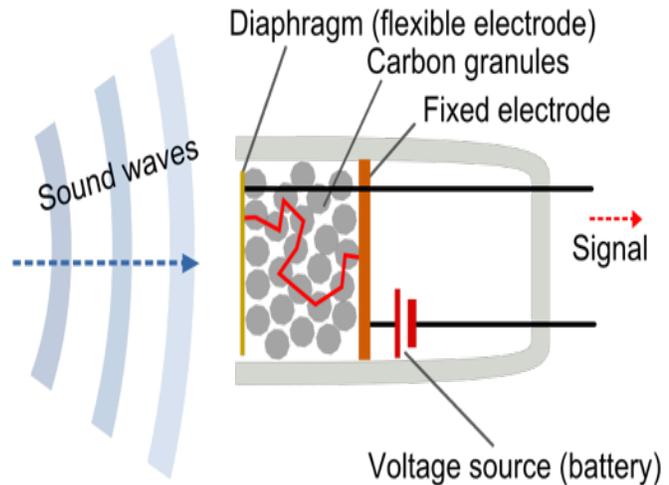


Handout 1 - How Microphones Work

Several inventors working on technology for telephones developed similar “microphones” in the 1870s. Thomas Edison received a patent for the “carbon transmitter” in 1877, though David Edward Hughes, researching separately, discovered similar technology during the same period. Hughes decided not to pursue a patent for his invention, though the name he gave it--“microphone”--stuck.

In a carbon microphone, granules of carbon are compressed between two diaphragms, one of which is electrified. Sound waves push against the thinner outer diaphragm and compress the granules against the thicker, electrified rear diaphragm. This pressure causes a fluctuation in the electric signal, and this electrical information is sent out through the microphone’s cable. The electrical signal is then either reproduced through a speaker or recorded in some fashion.



Though carbon microphones were sufficiently functional to remain the industry standard for telephone receivers into the 1980s, their limited dynamic range and noisiness were never well suited to recording music. During the 1920s several new types of microphones that relied on electrical amplification were introduced. Though there were several variations in construction, none relied on carbon.

The RCA 44, the favorite of Bing Crosby, is a “ribbon” microphone (pictured left) that captures sound by way of a thin metal ribbon suspended in a magnetic field in the center of the microphone. Pushed and pulled by sound waves, the ribbon smoothly conducts electrical

current through this field without the crackling associated with carbon microphones. There are a variety of ribbon microphone designs and they remain in wide use for recording.



Early Frank Sinatra
Publicity Photo

Though the early publicity photo of Frank Sinatra shown earlier in this lesson shows him with a RCA 44, he soon fell for the “heightened realism” of the Telefunken U47 “condenser” microphone and reportedly would record with no other. Like a carbon microphone, the condenser has a diaphragm with a thin, flexible front plate and thicker, fixed back. In a condenser microphone these plates are small and an external, electrical power source directs an electrical charge between them. When sound waves strike the thin front plate, it moves and alters the voltage creating an electrical signal.



Capitol Records ad featuring U47

Condenser microphones proved most accurate in the frequency ranges of the human voice and helped develop what many have called “the larger than life” sound of pop vocals beginning in the 1950s. According to engineer Alex Case, condenser microphones “etch vivid detail into the vocal track, boosting intelligibility and highlighting emotional

expression.” Sinatra’s Telefunken U47 condenser microphone featured in many of his publicity photos and even stood in place of him on the cover of the singalong album Capitol Records released featuring the Sinatra arrangements of Nelson Riddle without vocals.

Though the U47 was quite expensive--it’s \$390 price tag in 1950 is roughly \$3,900 in today’s currency--it became a staple of large recording studios and was used to record all kinds of music. Below, Bob Dylan sings into a Telefunken U47 at a 1960s recording session. Many of the earliest U47 microphones remain in use today.

201 M U-47 M

TELEFUNKEN world's finest Microphones

DOES THE WORK OF
5 OR 6 ORDINARY MICROPHONES

Extremely smooth frequency response, wide dynamic range, complete absence of distortion and noise. Readily changeable field pattern. Small outside switch provides either highly directional or non-directional characteristic.

The pencil-type microphone 201 M especially suited for broadcasting TV, recording, and motion pictures is indifferent to changes of temperature and humidity conditions. Its construction ensures continuous dependable operation at 175° F. without affecting its performance.

MODEL U-47M
Condenser Microphone,
power supply, cables
and plugs.
Complete **\$390⁰⁰**

Specifications—U 47 M

Frequency response ± 3db 30-16,000 cps.
Output impedance 30/50, 200/250 ohms, bal.
Field pattern non-directional or cardioid
Output level at 1000 cps.
Matched with 200 ohms—
	cardioid 2.8 mV per dynes/cm ² (—49 db)
	non-dir. 1.7 mV per dynes/cm ² (—53 db)
Residual noise level equivalent	24 db loudness
Non-linear distortion less than 1%

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