An Introduction to Electrical Engineering

History- Part II

Lectured by: Dr. A. Haghbin

19th century developments

- In 1873 James Clerk Maxwell stimulated several theorists to think in terms of fields described by Maxwell's equations.
- Bringing together for the first time electricity, magnetism, and light as different manifestations of the same phenomenon.

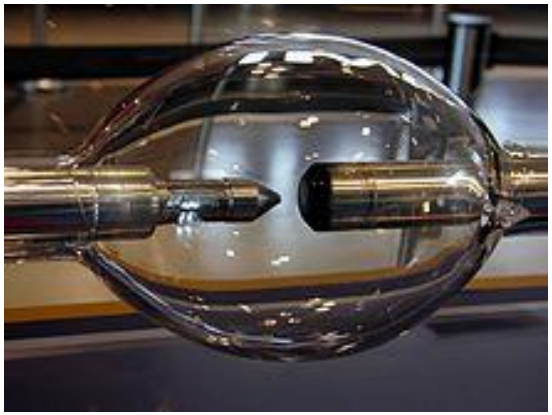
19th century developments

- Maxwell's equations for electromagnetism have been called the "second great unification in physics“ after the first one realized by Isaac Newton.
- The unification of light and electrical phenomena led to the prediction of the existence of radio waves.

19th century developments

- During the latter part of the 1800s, the study of electricity was largely considered to be a subfield of physics.
- It was not until the late 19th century that universities started to offer degrees in electrical engineering.
- Darmstadt University of Technology
- Massachusetts Institute of Technology

19th century developments



- Cornell University
- University College London
- University of Missouri
- During this period commercial use of electricity increased dramatically.
- Starting in the late 1870s cities started installing large scale electric street lighting systems based on arc lamps.

19th century developments

- After the development of a practical incandescent lamp for indoor lighting, Thomas Edison switched on the world's first public electric supply utility, using what was considered a relatively safe 110 volts direct current system to supply customers.
- Phonograph for the mechanical recording and reproduction of sound.

19th century developments

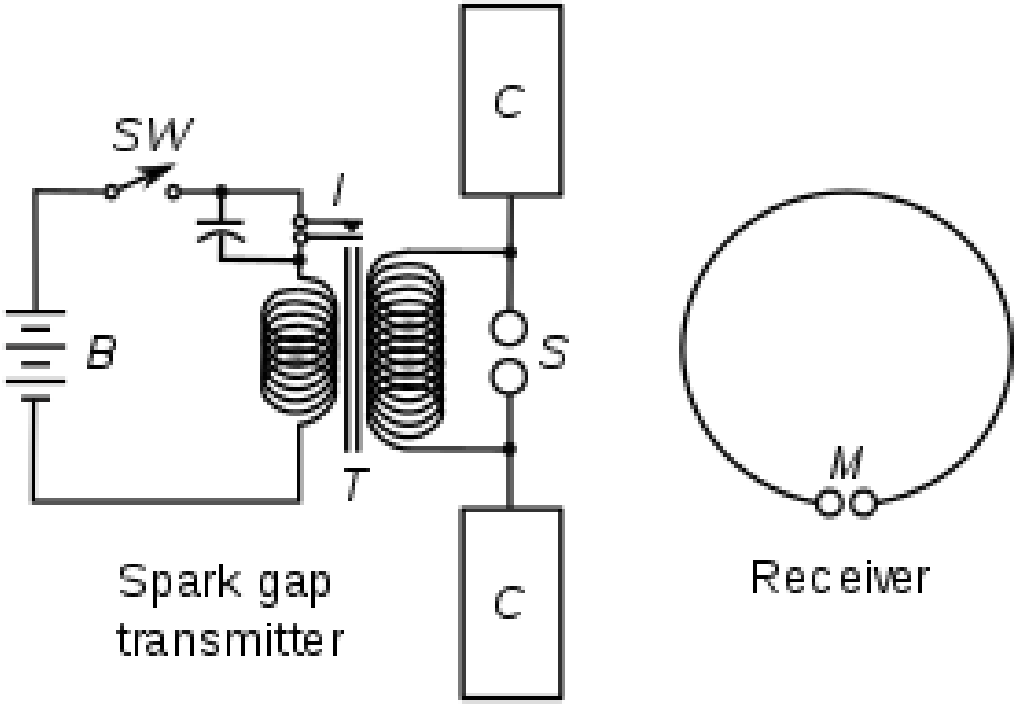
- He is often credited with establishing the first industrial research laboratory.
- In the US there was a rivalry, primarily between a Westinghouse AC and the Edison DC system known as the "War of Currents".

19th century developments

- Charles Proteus Steinmetz helped foster the development of alternating current that made possible the expansion of the electric power industry in the United States, formulating mathematical theories for engineers.

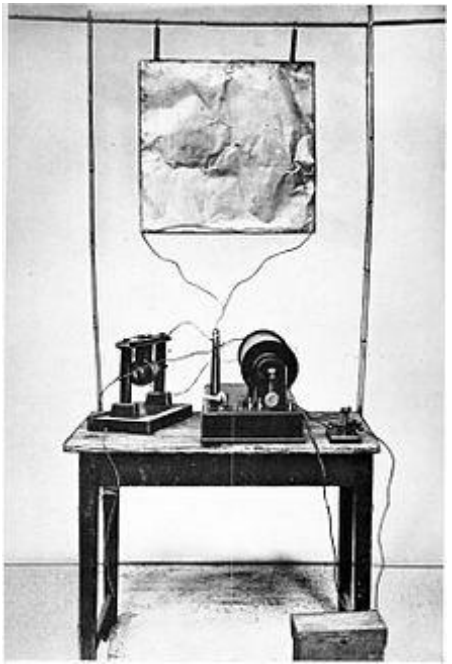
19th century developments

- In his classic UHF experiments of 1888, Heinrich Hertz demonstrated the existence of electromagnetic waves (radio waves)



19th century developments

- Guglielmo Marconi was an inventor and electrical engineer, known for his pioneering work on long-distance radio transmission, development of Marconi's law, and a radio telegraph system.



20th century developments

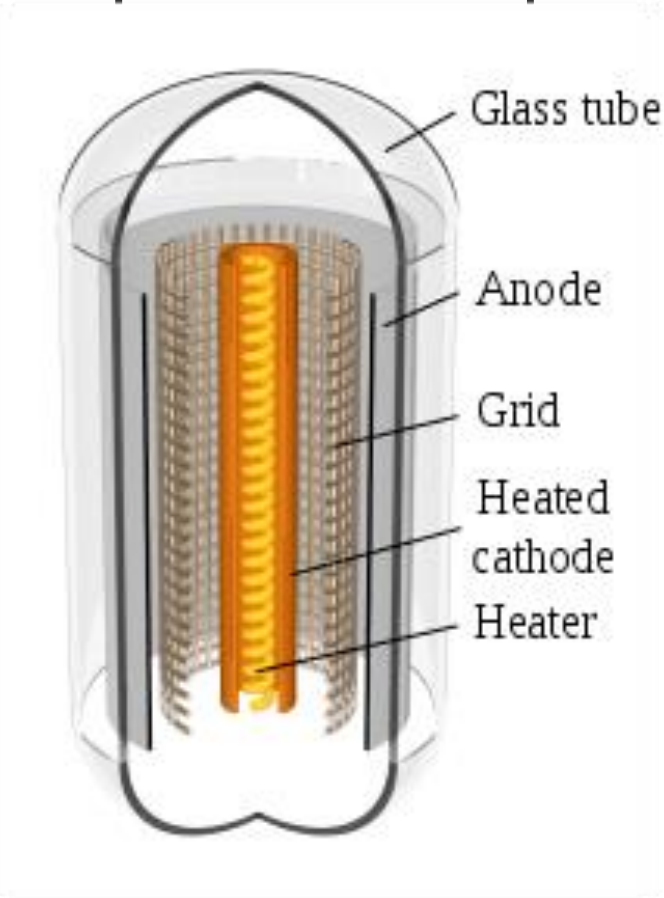
- John Fleming invented the first radio tube, the diode, in 1904.
- He also established the left-hand rule for electric motors.

20th century developments

- Reginald Fessenden recognized that a continuous wave needed to be generated to make speech transmission possible, and by the end of 1906 he sent the first radio broadcast of voice.
- Fessenden is best known for the foundations of amplitude modulation (AM) radio.

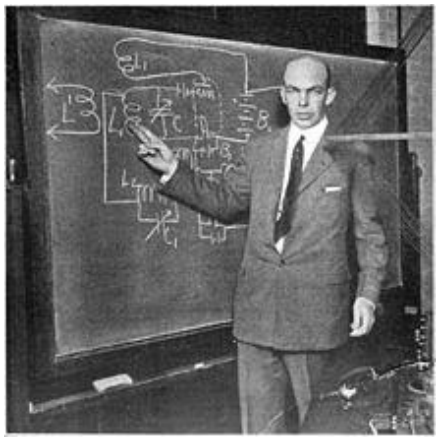
20th century developments

- Also in 1906, Robert von Lieben and Lee De Forest independently developed the amplifier tube, called the triode.



20th century developments

- Edwin Howard Armstrong enabling technology for electronic television, in 1931.
- He is best known for developing FM (frequency modulation) radio and the superheterodyne receiver system.
- He held 42 patents including wide-band FM radio and FM Doppler radar.



20th century developments

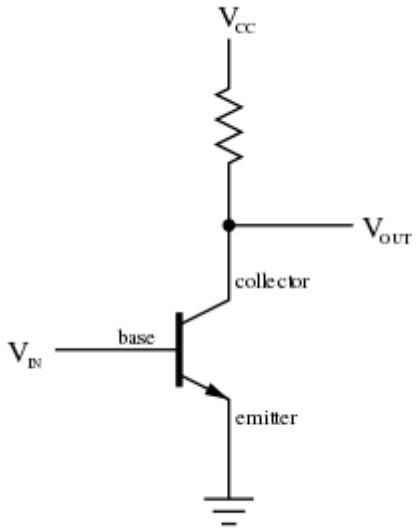
- **The second world war** saw tremendous advances in the field of electronics.
- These studies were published after the war in 'Radio Communication Series' published by McGraw-Hill in 1946.
- In 1941 Konrad Zuse presented the Z3, the world's first fully functional and programmable computer.

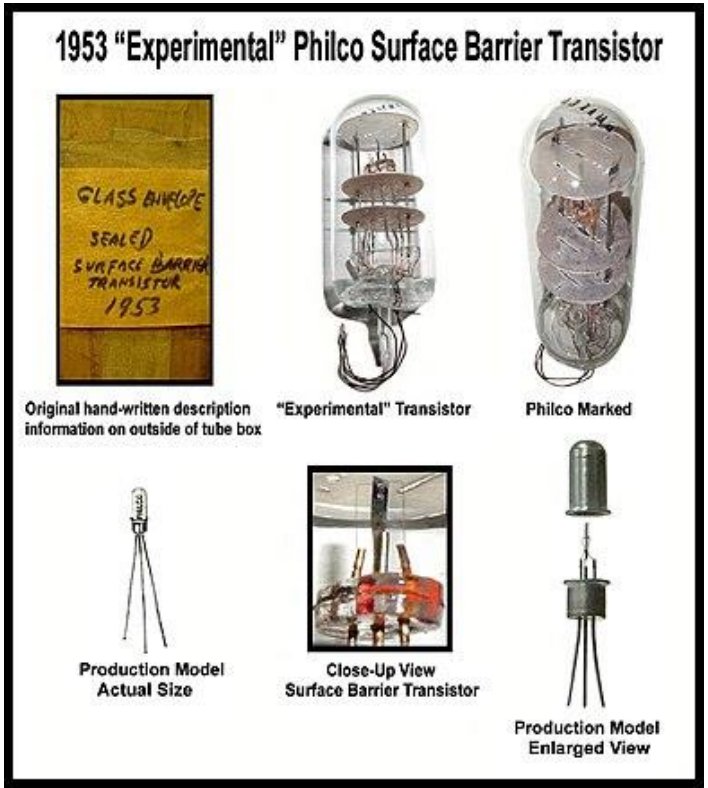
20th century developments

- Later, in post war years, consumer devices began to be developed.
- Electrical engineering field broadened to include modern TV, audio systems, Hi-Fi and latterly computers and microprocessors.

20th century developments

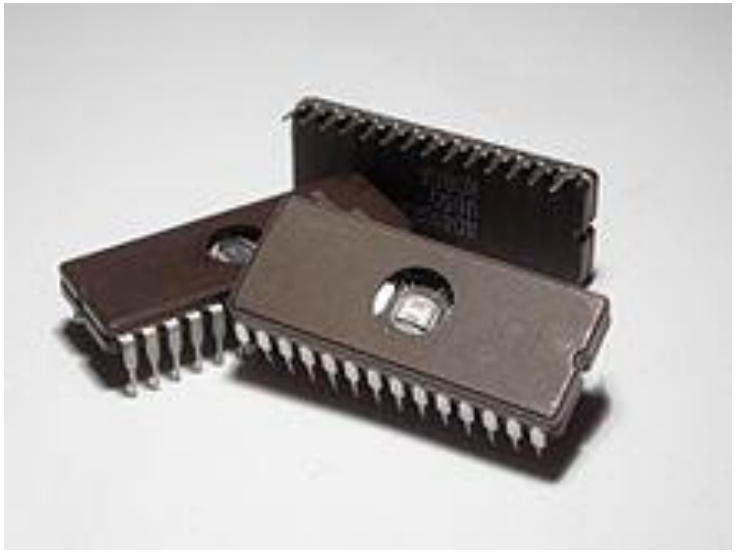
- The invention of the transistor in 1947 by William B. Shockley, John Bardeen and Walter Brattain opened the door for more compact devices.

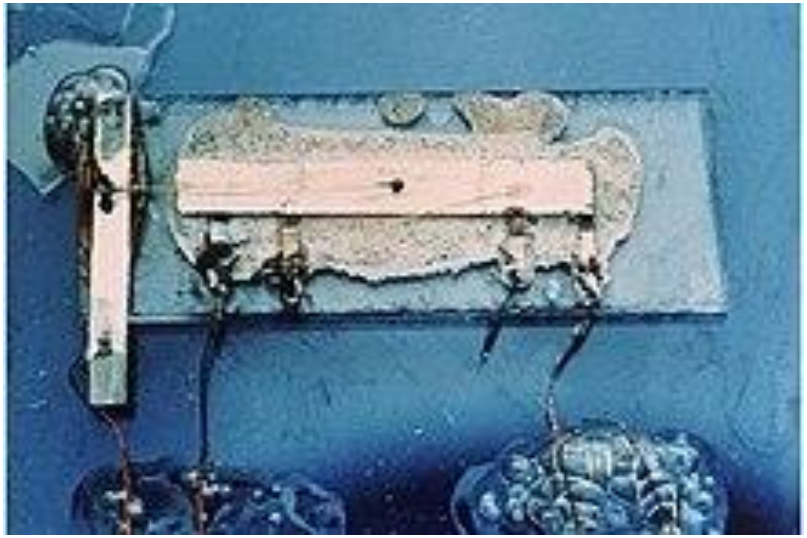




20th century developments

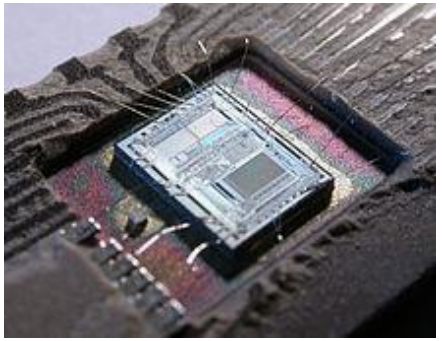
- This invention led to the development of the integrated circuit in 1958 by Jack Kilby and independently in 1959 by Robert Noyce.





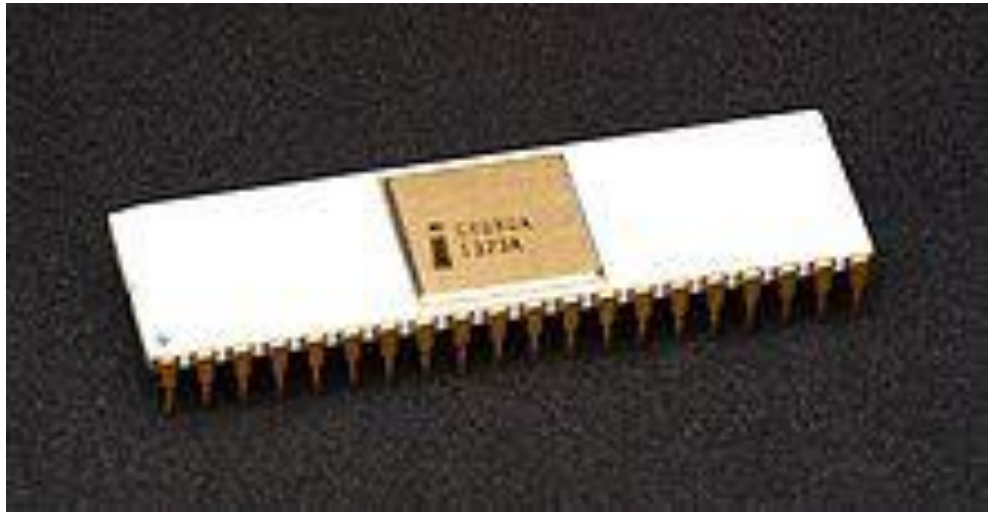
20th century developments

- In the mid to late 1950s, the term radio engineering gradually gave way to the name electronics engineering, which then became a stand-alone university degree subject.
- In 1968 Marcian Hoff invented the first microprocessor at Intel and thus ignited the development of the personal computer.



20th century developments

- The first realization of the microprocessor was the Intel 4004, a 4-bit processor developed in 1971, but only in 1973 did the Intel 8080, an 8-bit processor.



Any Question?

THANKS FOR YOUR ATTENTION