Timeline of the development of the oscilloscope

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1840-1850

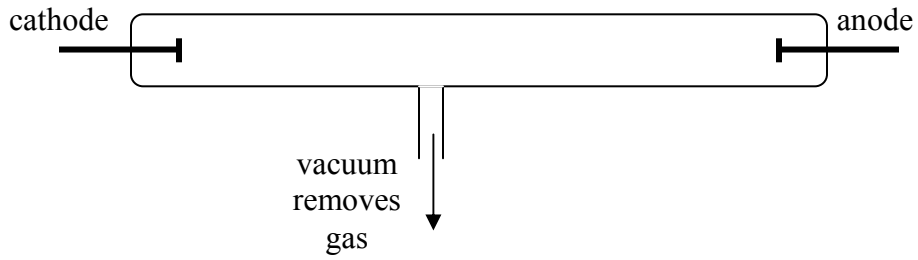
Many studies made of the beautiful phenomenon – discharge of electricity through low pressure gases.

A sealed glass tube containing a gas (e.g. hydrogen, helium, nitrogen, carbon dioxide) is connected to a high voltage source (e.g. an induction coil). The discharge from an induction coil passes between the negative terminal (the cathode) and the positive terminal (the anode). The gas glows. Different types of gases glow different colours (red, pink, yellow, orange, purple).

1852-1855

William Crookes (English) discovered "cathode rays" when he evacuated the gas from a gas discharge tube. The equipment Crookes used was called a Crookes tube but later called cathode ray tubes.

Diagram of a Crookes tube:



1860-1890

Cathode ray tubes were coated with a fluorescent material that glows when the cathode ray strikes it. This made cathode rays easier to detect.

Further experiments demonstrated that cathode rays could turn a pinwheel, travel in straight lines and be deflected by magnetic fields.

It was proposed that the "cathode rays" were in fact charged particles.

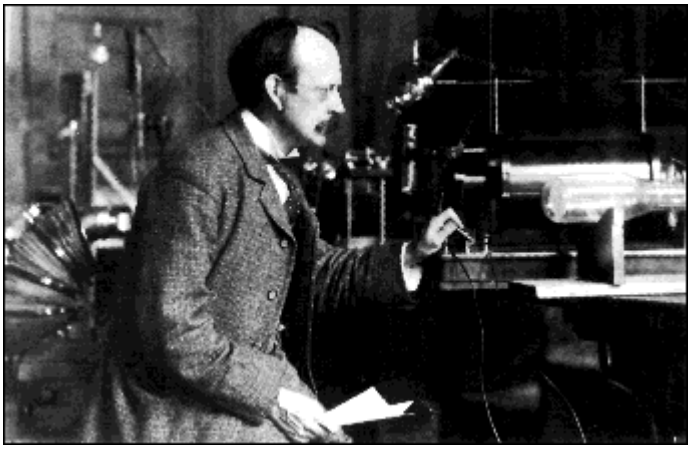
1895

Jean-Baptiste Perin used a cathode ray tube attached to an electroscope to demonstrate that cathode rays had a negative charge.

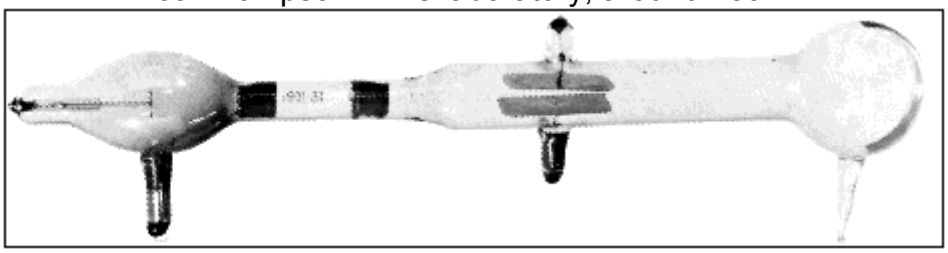
1897

J.J. Thompson (English) used electric and magnetic fields and a cathode ray tube to determine the charge to mass ration $\{\frac{e}{m}\}$ of the "cathode ray" particles.

Cathode rays are given the name "electrons" a name George Stoney had previously invented for the minimum quantity of electrical charge. Thompson is generally credited with "discovering" the electron.



JJ Thompson in his laboratory, around 1897.



The cathode ray tube used by Thompson to determine $\frac{e}{m}$. This tube was made by hand.

Special Note: At this time there was great rivalry between German and British researchers. As concerning the nature of the cathode ray, the Germans tended to the explanation that cathode rays were a wave (like light), whereas the British tended to believe that the cathode ray was a particle. As events unfold over the next few decades, both will be proven correct.

1897
Meanwhile Karl Braun (German) develops the first cathode ray oscilloscope known as the “Braun tube”.

1900-1920
Early oscilloscopes developed and were known as high voltage oscillographs. They used cold cathode devices. In the absence of suitable amplifiers the voltage waveforms to be investigated were applied directly to the cathode ray tube itself. The displayed “curve” was extremely small. To use the curves the screen was usually photographed and then enlarged. Only a single sweep could be taken.

1920s
Cold cathode device replaced by low voltage incandescent cathodes, this resulted in a much brighter and more focused beam.

1922
Western Electric produces the Johnson tube. This was the first commercially produced direct viewing oscilloscope.

1920-1930
Different techniques used to further improve the focus of the oscilloscope trace.

1930s
Time base generators are developed so a continuous waveform could be displayed.

1939-1945
World War 2. Many scientists and engineers employed by the defence forces (German, English, USA, Australia, Italy, Japan etc) during this period. Work on the development of RADAR by the allies resulted in many advances to oscilloscope technology including:
Improved amplification of voltage waveforms
Triggering for time base
Multiple inputs
More accurate amplitude measurement

1945-1950
Following World War 2 when military technologies became available to industry an English company called COSSOR and an American company called Tektronix manufactured oscilloscopes in large numbers.

1960s

Introduction of integrated circuits radically changes the internal workings of the oscilloscopes. The cathode ray tube is the only “valve” left in the oscilloscope.

1970s

More oscilloscopes are in use than any other single item of electronic test equipment.

1980s

Multi-coloured traces for displaying data are used for the first time. Development of digital technology allows digital inputs to be used with oscilloscopes.

1990s

Modern personal computer technology has developed to the point that voltage waveforms can input directly to the computer data card. The computer monitor is the cathode ray tube in this set up.

Research Assignment – Oscilloscope

Use the internet to collect the following information:

1. Find a picture of an oscilloscope manufactured after World War 2 (1960 or earlier).
2. Find a picture of a modern digital oscilloscope (2000 or later).
3. What would a physicist or electrical engineer use an oscilloscope for? Give at least two different examples.
4. What would a medical practitioner use an oscilloscope for? Give at least one example and find a picture of it.
5. What cathode ray tube *application* would most people would use at least once a week? Give at least three examples.

Try the following keywords using a search engine:

- Cathode ray tube
- Oscilloscope
- Television
- COSSOR
- Tektronix