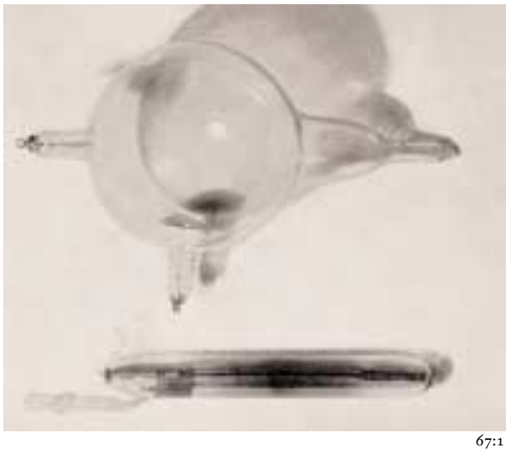


67:1

67:2

67:3

Hand des Anatomen Geheimrath von Kölliker.
Im Physikal. Institut der Universität Würzburg
mit X-Strahlen aufgenommen
von Professor Dr. W. C. Röntgen.

67:4

The famous X-ray picture of the hand of Albert von Köllicker (see #65), from the first publication of Röntgen's discovery.

The equipment used by Wilhelm Röntgen (1845–1923) in his very first experiments with X-rays. Vacuum tubes, an electromagnetic coil employed in his attempts to deflect the X-rays and a plate of lead with apertures for studying the absorption of different materials.

BORN in Lennep in 1845, Röntgen was the only child of a cloth manufacturer. He was first educated at the Utrecht Technical School and later entered the Polytechnic at Zürich, where he received his diploma and doctorate in mechanical engineering in 1868. He was appointed to the chair of physics at the University of Giessen in 1879 and became director of the Physical Institute at the University of Würzburg and, after his epochal discovery of X-rays in 1895, he was also made honorary doctor of medicine. In 1900 Röntgen moved to Munich and the following year he received the first Nobel Prize in Physics. Of a retiring nature, Röntgen shunned public engagements, even declining to deliver the Nobel lecture. He retired in 1920 and died after a short illness three years later.

67:5 Wilhelm Conrad Röntgen

Ueber eine neue Art von Strahlen.

SITZUNGB D WÜRZBURGER PHYSIK-MED GES JAHRG 1895. P132.
WÜRZBURG: VERLAG DER STAHEL'SCHEN BUCHHANDLUNG; 1896

RÖNTGEN ANNOUNCES his discovery of an unknown radiation "X-Strahlen" emanating from a cathode ray tube covered with black paper. He finds that the ray penetrates easily many materials, including aluminium, but not a 1.5-mm thick lead plate. He is unable to reflect, refract or diffract the radiation, nor can he produce interference phenomena or deflection with electrical fields. He notes that X-rays always emanate at the glass wall where the tube is struck by the cathode ray. Finally, he observes that the radiation blackens photographic plates and uses this to document his experiments and to produce "shadows of handbones".

IN PERSPECTIVE:
At the end of the 19th century cathode ray tubes were extensively used in investigations of electrical discharge phenomena in gases (67.1)(67.2)(67.3). These studies culminated in the discovery of the electron by Thomson in 1897 (67.4). Following Röntgen's announcement, Carl Müller (later "Röntgenmüller") promptly started commercial production of X-ray tubes, and developed a much improved water-cooled model in 1899. The modern tungsten filament X-ray tube was invented by Coolidge at the General Electric Research Laboratory in 1913 (67.5). The medical community immediately recognised and continuously developed the extraordinary potential of X-rays for diagnostic purposes, the CAT scanner being among the latest developments in this field (67.6). Sjögren reported the first successful use of X-rays for cancer treatment in 1899 (67.7). Also many new diagnostic techniques were able to be developed under X-ray image control (67.8). In a major advance, Laue discovered the X-ray diffraction method in 1913 (67.9) that has ever since been the cornerstone of structural determinations of complex molecules in general (67.10) and those of biomedical interest in particular (67.11).

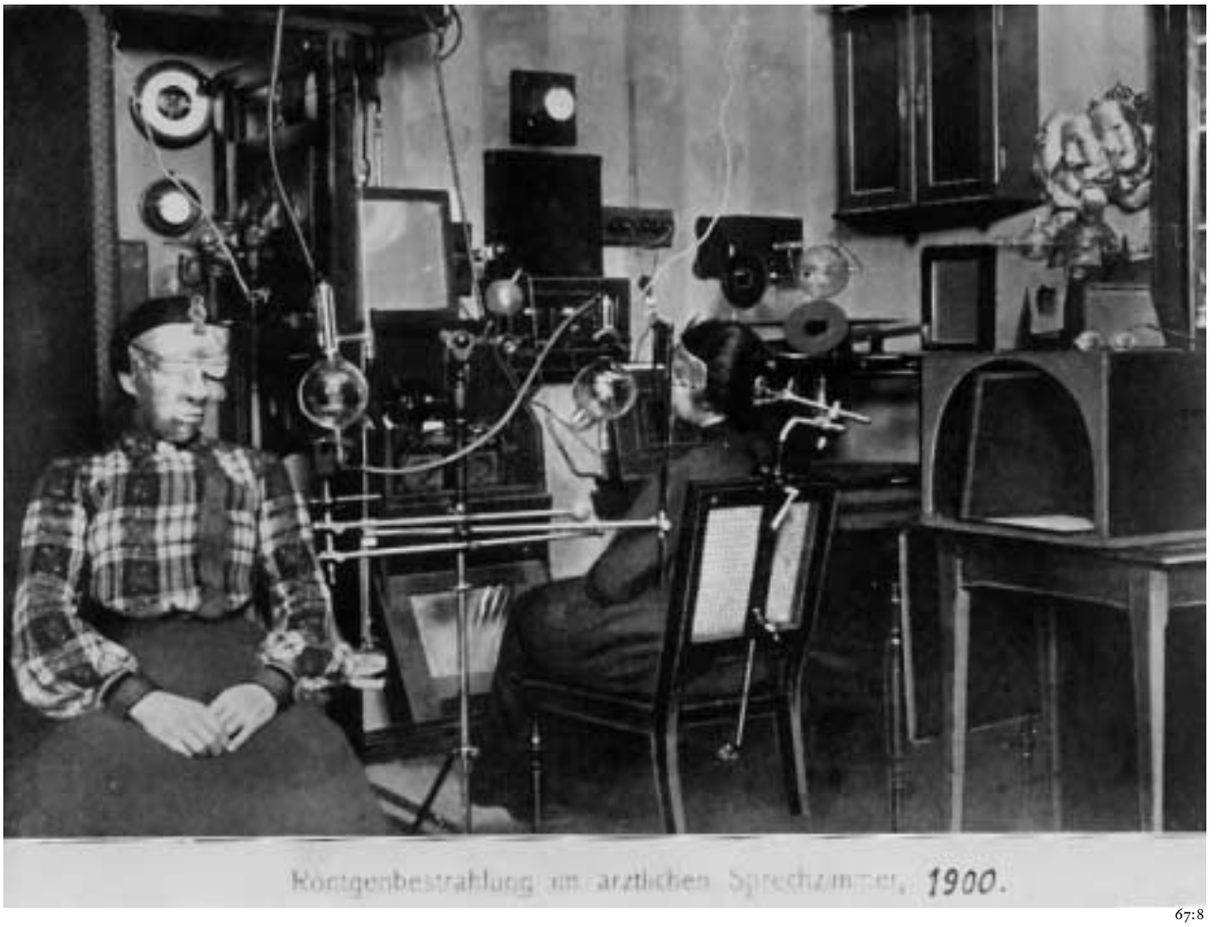
67.1 Plücker J. Über die Einwirkung des Magneten auf die elektrischen Entladungen in verdünnten Gasen. *Ann Phys Chem* 1858; 103:88. p151, p113.
67.2 Hittorf W. Über die Elektricitätsleitumg der Gase. Erste Mitteilungen. *Ann Phys Chem* 1869; 136:1.
67.3 Crooks W. Contributions to molecular physics in high vacua. *Phil Trans Roy Soc* 1879; 170:641.
67.4 See #69 Thomson page 356.
67.5 Coolidge WD. *Improved x-ray tube.* US Patent 1,203,495 1916.
67.6 See #95 Hounsfield page 492.
67.7 Sjögren TA. *Fall af epiteliom behandladt med Röntgenstrålar.* Förh Sv Läkare-Sällsk Sammank Stockholm; 1899. p208.
67.8 Seldinger SI. Catheter replacement of the needle in percutaneous angiography. A new technique. *Acta radiol* 1953; 39:368. See also ref. 56.10.
67.9 See #76 Laue page 390.
67.10 See ref. 78.6
67.11 See #76 Laue page 390 and #88 Watson-Crick page 456.

67:6

William Coolidge (1873–1975) with his newly developed X-ray tube, which was first used in a clinical setting in 1913. A major advance in X-ray technology, it has a high-vacuum tube with heated tungsten filament as cathode and a tungsten disc as an anode.

Vacuum tubes designed by William Crookes (1832–1919) (at the back of the image) and by Coolidge (in the middle) and by Carl Müller (1845–1912) (front). Crookes builds vacuum tubes in the last decades of the 19th century as part of his investigations of the properties of rarefied gases. Müller starts commercial manufacture of X-ray tubes only months after Röntgen's discovery.

67:7



67:8

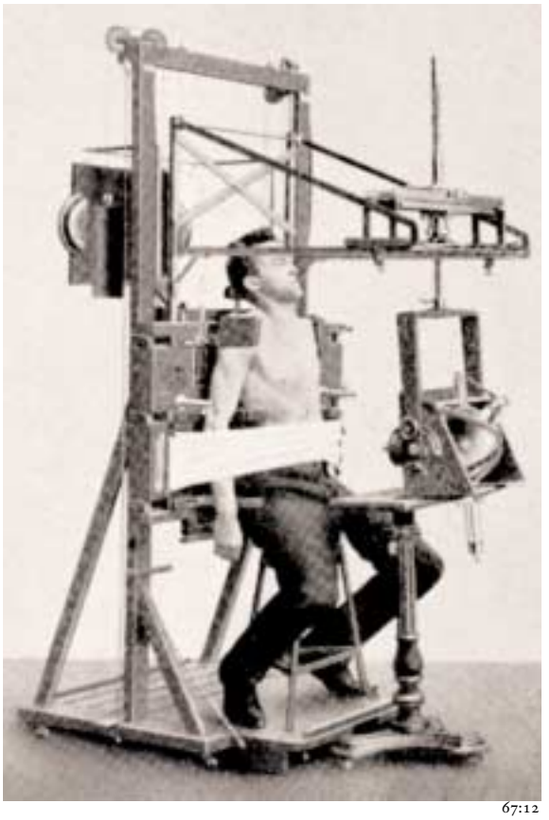
X-ray treatment in the doctor's office in 1900.

67:9

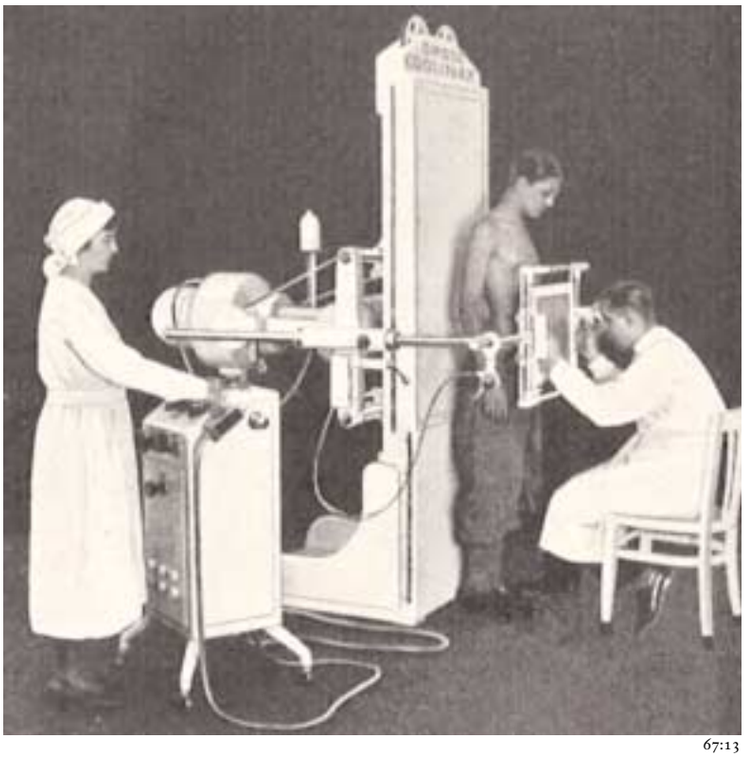
67:11

67:10

Siemens & Haske X-ray equipment from 1912.



67:12



67:13

67:14

X-ray equipment "Grosscoolinax" from 1933 (at the top).

X-ray room in Caecilien-Krankenhaus Berlin 1935.

67:15

67:16

X-ray equipment for mass radiography and a mobile X-ray unit ("Pleromobil") for operating rooms, both from 1952.