

19 U.S. Patents Granted with Godfrey Newbold Hounsfield as Either Sole or Lead Inventor

The following 19 patents are in addition to US 3,778,614 and US 4,052,619, which provide specific support for the CT Scanner Milestone.

- [Radiographic apparatus with correction for radiation hardness variations](#)

Patent number: 4118628

Abstract: In a radiographic apparatus employing a fan-shaped spread of penetrating radiation the nature of the source can cause the energy spectrum of the radiation to be variable with position in the fan. Means are provided to modify output signals from the apparatus to correct for errors caused by such variations. The modifying factors required can be calculated or can be determined using a phantom body by a method which is described.

Type: Grant

Filed: May 3, 1977

Date of Patent: October 3, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

- [Radiology](#)

Patent number: 4118629

Abstract: Computerized tomographic apparatus is capable of producing representations which show, with high accuracy, the absorption coefficients, with respect to x-radiation, at various locations distributed over one or more selected cross-sectional slices of a patient's body. The evaluation of the absorption coefficients is effected by determining the absorption suffered by the radiation on traversing each of many substantially linear paths from a source of the radiation to a detector means, the paths traversing the body slice. The invention resides in compensating for changes in the energy spectrum of the radiation as projected through the body along different ones of said paths, which changes could otherwise impair the accuracy of said representations.

Type: Grant

Filed: March 11, 1977

Date of Patent: October 3, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

19 U.S. Patents Granted with Godfrey Newbold Hounsfield as Either Sole or Lead Inventor

- [Radiography](#)

Patent number: 4115698

Abstract: Radiographic apparatus is described for evaluating the absorption coefficient of a body at each of a plurality of locations distributed over a slice of a body. A source is arranged to produce a fan-shaped beam of radiation which is directed through the body and the source is orbited around the body about an axis intersecting the slice. Detectors are provided, and orbited in synchronism with the orbital motion of the source, each to detect the radiation emergent from the body along a plurality of paths. A lateral scan is imposed on the source relative to the detectors, the scan being repetitive so that, during each scan, each detector receives radiation along a plurality of mutually inclined beam paths. The beam paths thus examined are sufficient in number and distribution to allow the construction of composite measurements for a plurality of sets of composite, parallel beam paths distributed over the slice for processing to derive a representation of absorption coefficients for the slice.

Type: Grant

Filed: October 19, 1976

Date of Patent: September 19, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

- [X-ray tube cooling arrangement](#)

Patent number: 4115697

Abstract: In a computerized tomographic apparatus for radiographic apparatus it has been proposed to orbit a source of X-radiation through several revolutions of the body of the patient. It is desirable to provide cooling to remove generated heat from the X-ray source, this being usually achieved by a cooling fluid such as oil. It is now proposed to provide a closed circuit cooling arrangement, for the source, comprising a circulatory oil path mounted to share in the orbit of the source without external fluid connections. To assist in cooling, the circuit is provided with a radiator and arranged such that, during pauses in the orbit, the radiator is brought to rest in a forced draught from a non-orbiting cooling fan.

Type: Grant

Filed: May 17, 1977

Date of Patent: September 19, 1978

Assignee: EMI Limited

Inventors: Godfrey Newbold Hounsfield, Anthony Michael Williams

**19 U.S. Patents Granted with
Godfrey Newbold Hounsfield as Either Sole or Lead Inventor**

- [Radiography](#)

Patent number: 4114040

Abstract: In computerized axial tomographic apparatus, arranged to provide an image of the variation of absorption coefficient over a planar slice of a patient's body, means are described for permitting a region of particular interest, within said slice, to be investigated in detail. To this end, the body is irradiated with a spread of radiation in the plane of said slice, the spread being rotated around the body. During the rotation the median line of the spread is not generally concurrent with the axis of rotation, but instead is preferably concurrent with the center of said region of particular interest.

Type: Grant

Filed: February 5, 1976

Date of Patent: September 12, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

- [Apparatus for examining bodies by means of penetrating radiation](#)

Patent number: 4103169

Abstract: An apparatus is disclosed for examining a body by means of penetrating radiation in which the radiation is provided in the form of a sector subtending a predetermined angle at the radiation source and detected by an array of detectors in the plane of the sector. The source and detectors are scanned laterally in the plane of the sector and orbited about an axis perpendicular to that plane at an angular rate which takes account of the angle subtended by the sector. Output signals produced by the detectors related to radiation incident at different angles in the sector during the scanning movements, are used to construct a distribution of absorption coefficients for a planar slice of the body.

Type: Grant

Filed: January 23, 1976

Date of Patent: July 25, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

19 U.S. Patents Granted with Godfrey Newbold Hounsfield as Either Sole or Lead Inventor

- [Apparatus for examining objects by means of penetrating radiation](#)

Patent number: 4096390

Abstract: Apparatus for examining a human patient by means of penetrating radiation has a source of radiation for producing a sectoral swath of radiation which traverses a planar slice of the patient and is then measured by a bank of detectors each of which is sensitive to a narrow beam of the radiation in said swath. The swath of radiation is produced by a rotating anode Collidge tube and means are provided for monitoring the radiation intensity at spaced positions across the width of the swath and for taking account of variations of the intensity in the output signals derived from the detectors. Preferably radiation emitted from the anode at near tangential directions is selected to form the swath.

Type: Grant

Filed: July 27, 1977

Date of Patent: June 20, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

- [Scanning radiology with initial scan for adjusting system so that detector means operates within its preferred range](#)

Patent number: 4091287

Abstract: In a radiological apparatus, arranged to produce a representation of the variation of absorption of penetrating radiation over a planar, cross-sectional slice of a body under examination, the radiation emergent from the body along a plurality of paths in the plane of the slice is detected by detector means including one or more photomultipliers. The output signals from the photomultiplier or photomultipliers are monitored and compared with upper and lower threshold levels which represent the extremes of substantially linear operation of the photomultiplier or photomultipliers. In the event of the output signals departing from the range defined by said threshold levels a correction signal is generated and utilized to tend to restore the output signals within said range.

Type: Grant

Filed: January 28, 1976

Date of Patent: May 23, 1978

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

19 U.S. Patents Granted with Godfrey Newbold Hounsfield as Either Sole or Lead Inventor

- [Apparatus for examining objects by means of penetrating radiation](#)

Patent number: 4069422

Abstract: In an apparatus for examining a body by means of penetrating radiation, a source directs a fan-shaped distribution of radiation through a slice of a patient. Detectors disposed on the other side of the body provide measurements of the intensity of the radiation for processing to derive a representation of absorption in the slice. Variations of the hardness of the radiation, with angular position in the fan-shaped distribution, can cause errors in the representation. Means are provided for compensating such variations of hardness; the means being in one example a wedge-shaped compensator inserted into the path of the radiation.

Type: Grant

Filed: February 18, 1976

Date of Patent: January 17, 1978

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

- [Scanning radiographic apparatus](#)

Patent number: 4066906

Abstract: In a scanning radiographic apparatus in which the object of the scanning is to project the radiation through a substantially planar region of a body along many linear paths, means is provided for monitoring the progress of the scanning and producing timing signals indicative thereof. The timing signals are used to determine, at least in part, the widths of the aforementioned beams and a characteristic, for example the frequency in the event that the signals comprise pulses, is changed to permit the effective width of the paths to be changed. This can be done by means of graticules having differently pitched markings, for example, and each graticule may be associated with a respective range of body sizes.

Type: Grant

Filed: June 2, 1976

Date of Patent: January 3, 1978

Assignee: EMI Limited

Inventors: Godfrey Newbold Hounsfield, Peter George Langstone

**19 U.S. Patents Granted with
Godfrey Newbold Hounsfield as Either Sole or Lead Inventor**

- [Packing member for radiographic positioning means](#)

Patent number: 4053781

Abstract: In an apparatus for examining a body by means of penetrating radiation a flexible member, containing material, having an absorption to the radiation similar to that of human tissue, is placed in a bag in contact with the body to provide support therefore. The absorbing material may be a viscous material or may be a particulate material which behaves substantially in a viscous manner.

Type: Grant

Filed: December 24, 1975

Date of Patent: October 11, 1977

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

- [Method and apparatus for measuring and analyzing radiation transmitted at plural angles](#)

Patent number: 4052619

Abstract: In an apparatus for examining a body by means of penetrating radiation a source of the radiation and a detector are arranged to orbit about the body. Data obtained from the detector are used to provide a representation of the distribution of absorption in part of the body. To reduce patient movement artefacts in the reconstructed image some of the data are obtained for substantially the same radiation paths through the body, but at different times, and are combined after weighting by complementary factors.

Type: Grant

Filed: February 5, 1975

Date of Patent: October 4, 1977

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

19 U.S. Patents Granted with Godfrey Newbold Hounsfield as Either Sole or Lead Inventor

- [Apparatus for examining a body by radiation such as X or gamma radiation](#)

Patent number: 4052618

Abstract: Computerized tomographic apparatus is disclosed wherein respective edge value signals, indicative of the absorption suffered by penetrating radiation, such as X-radiation, on traversing each of a large number of substantially linear paths through a cross-sectional slice of a body, are acquired and processed in order to produce a representation of the absorption of said radiation at many locations distributed over the slice. It is disclosed that the acquisition of said edge value signals can be carried out in a number of different ways and that the processing is effected in accordance with a compensated layer grammaing technique.

Type: Grant

Filed: February 12, 1976

Date of Patent: October 4, 1977

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

- [Radiography](#)

Patent number: 4048505

Abstract: Medical radiographic apparatus is described in which a source of a fan-shaped spread of X-radiation is arranged to project the radiation through a cross-sectional slice of a body under examination. Collimators are used to section up the radiation emergent from the body into finger-like beams which have traversed respective, substantially linear paths through said slice. The source is angularly moved around the body so as to project radiation through said slice from a plurality of directions relative thereto. The collimators also perform the angular movement and means are provided to cause the said paths traversed by the beams at one time during the angular movement to interleave with the paths traversed by the beams at another time during the angular movement.

Type: Grant

Filed: January 16, 1976

Date of Patent: September 13, 1977

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

**19 U.S. Patents Granted with
Godfrey Newbold Hounsfield as Either Sole or Lead Inventor**

- [Radiography](#)

Patent number: 4044260

Abstract: In a radiographic apparatus employing a fan-shaped spread of penetrating radiation the nature of the source can cause the energy spectrum of the radiation to be variable with position in the fan. Means are provided to modify output signals from the apparatus to correct for errors caused by such variations. The modifying factors required can be calculated or can be determined using a phantom body by a method which is described.

Type: Grant

Filed: March 18, 1976

Date of Patent: August 23, 1977

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield

- [Computerized tomography comprising laterally shifting detected beams within a rotated fan of radiation](#)

Patent number: 4041315

Abstract: A method of radiographically examining a body is disclosed, wherein a spread of penetrating radiation is projected through a cross-sectional region of the body from a plurality of locations distributed angularly around the body, thus permitting the derivation of signals indicative of the absorption suffered by the radiation on traversing said region along each of a number of mutually divergent beam paths within said spread, for each of said locations. The positions of the beam paths within the spread for irradiation of the body from some of said locations differ from the positions of said paths within said spread for irradiation of the body from others of said locations so as to permit the derivation of signals relating to interleaving beam paths through said region.

Type: Grant

Filed: January 19, 1976

Date of Patent: August 9, 1977

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

**19 U.S. Patents Granted with
Godfrey Newbold Hounsfield as Either Sole or Lead Inventor**

- [Radiography](#)

Patent number: 4035647

Abstract: Apparatus is disclosed for producing a representation of the absorption coefficient, with respect to X- or .gamma.- radiation, at a plurality of locations distributed over a planar section of a body under examination. The radiation is directed towards the body in a planar swath which embraces the section, and the radiation emergent from the body is detected by means of an array of detectors. The swath of radiation and the detector array are rotated steadily about an axis perpendicular to the plane of the swath, and passing through the body, so that the section is irradiated from a plurality of different directions.

Type: Grant

Filed: June 20, 1974

Date of Patent: July 12, 1977

Assignee: E M I Limited

Inventors: Godfrey Newbold Hounsfield, David John Gibbons

- [Radiography](#)

Patent number: 4029948

Abstract: In an apparatus for displaying representation of body sections derived, for example, from a diagnostic X-ray apparatus a further representation is provided for another body section by interpolation between the derived representations. The data for elements of the derived representation are stored and those relating to corresponding elements are withdrawn simultaneously for the interpolation to provide the corresponding element of the further representation. Any of the representations may be displayed individually or they may be displayed successively in a sequence relating to their position in the body.

Type: Grant

Filed: July 10, 1975

Date of Patent: June 14, 1977

Assignee: E M I Limited

Inventor: Godfrey Newbold Hounsfield

**19 U.S. Patents Granted with
Godfrey Newbold Hounsfield as Either Sole or Lead Inventor**

• [Radiology](#)

Patent number: 4028554

Abstract: In a radiological apparatus wherein radiation is passed through a body along a plurality of co-planar paths, attenuator means is utilized to tend to compensate for differences in the lengths of said paths within a body being examined. The attenuator means, however, introduces a variation into the radiation spectrum and the invention provides means for compensating for such variation. Such compensating involves processing output signals derived from detector means disposed to receive the radiation after it has traversed the body and the attenuator means.

Type: Grant

Filed: June 5, 1975

Date of Patent: June 7, 1977

Assignee: EMI Limited

Inventor: Godfrey Newbold Hounsfield
