Test body arrangement.

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References cited:
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PROCEEDINGS OF THE SYMPOSIUM ON MEDICAL RADIOISOTOPE SCANNING, April 1964, I.A.E.A., pages 153-173, Vienna (AT); W.J. MacINTYRE et al.: "The evaluation of straight-bore, tapered and focusing collimators as a function of gamma-ray energy".

Proprietor: GENERAL ELECTRIC COMPANY
1 River Road
Schenectady New York 12305 (US)

Inventor: Guyton, Peter Firth
11 Holt Close
Elstree Hertfordshire WD6 3QH (GB)
Inventor: Lonn, Albert Henry Roger
52 Abbey Avenue
St. Albans Hertfordshire AL3 4AZ (GB)

Representative: Orchard, Oliver John
JOHN ORCHARD & CO. Staple Inn Buildings
North High Holborn
London WC1V 7PZ (GB)

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HEALTH PHYSICS, vol. 28, no. 5, May 1975, pages 591-597, Pergamon Press, N. Ireland (Ir); S.M. GARRY et al.: "Measurement of absorbed fractions for photon sources distributed uniformly in various organs of a heterogeneous phantom".

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References cited:
JOURNAL OF NUCLEAR MEDICINE, vol. 8, 1967, pages 829-836, New York (USA); E.
JAHNS et al.: "A line-source phantom for
testing the performance of scintillation
cameras".

PROCEEDINGS OF THE SYMPOSIUM ON
MEDICAL RADIOISOTOPE SCINTIGRAPH,
August 1968, I.A.E.A., pages 31-42, Salzburg
(AT); G.S. FREEDMAN et al.: "The image
intensifier scintillation camera and single-
crystal camera".
Description

This invention relates to a test body arrangement (otherwise known as a Test Phantom) for use in checking the performance of apparatus which detects the emission of radioactive radiations from a body by means of a detector assembly positioned at a given distance from the body. The detector assembly consists, in one embodiment, of a radiation sensitive element which extends over an area in a plane. Such a detector assembly produces a planar image which may be in the form of a matrix arranged in rows and columns, suitable for subsequent computer processing. It is, of course, possible for the detector assembly to be arranged in other than a plane, for example the assembly could be arranged on a curve about a longitudinal axis of the body from which the radiations are detected. Furthermore, the detector assembly may be so mounted that it can be rotated about the body. The planar views obtained by the detector assembly at various incremental positions around the body may be reconstructed to form transaxial sectional views of that body.

One form of phantom or test body arrangement for testing the operating characteristics of a tomographic analytical apparatus is described in U.S. Patent Specification No. US—A—4,055,771. The embodiments described therein disclose the use of X-ray energy absorption means which are arranged in a predetermined configuration within the body and which includes a fluid bath chamber.

A variety of phantoms, each of which is of a different construction and is used for a different purpose from the test body of the present invention, is cited in the search report accompanying this application.


The MacIntyre article describes the comparison of such collimators with phantoms consisting of either one or a series of simple flat cylindrical discs having a small defect or displacement.

On page 158 of the article it is said, “it was decided to evaluate the contribution of individual sections of an extended source by separating these contributions into 1-cm-thick segments. Only one of these segments contains radioactive material. Within it was placed a volume of varying size containing either no radioactivity, or increased radioactivity. The other segments contain water or a tissue equivalent material.” Other similar arrangements are described.

The stack of disc sections placed one on top of the other is quite different from the test body of the present invention and the application of the present test body is different from that of the phantom in the MacIntyre article.

In an article by S. M. Garry et al, “Measurement of absorbed fractions for phantom sources distributed uniformly in various organs of a heterogeneous phantom”, Health Physics, vol. 28, No. 5, May 1975, pages 591—597 Pergamon Press, N. Ireland, there is described the measurement of dose distribution within a phantom resulting from photon emitters distributed uniformly in parts of the phantom representing selected organs, by means of dosimeters positioned within the phantom.

In an article by Eberhard Jahns et al, “A line-source phantom for testing the performance of scintillation cameras”. Journal of Nuclear Medicine, vol. 8, 1967 pages 829—936 New York (USA), a “geometrical” phantom, consisting of a network of grooves in which are placed thin plastic tubes containing radioactive solutions, is described as providing a line-source for testing the performance of scintillation cameras.

In US Patent Specification No US—A—3,509,337, also cited in the search report, a system is described for simultaneous multi-section tomography including a multiple film book cassette et the image plane and, at the object plane, a test object consisting of a cylinder with a number of longitudinal bores housing adjustable pistons which carry lead wafer identification numbers, so that the presence of an individual lead number in sharp focus in a developed X-ray picture indicates the plane of focus for the picture.

The scope of the present invention is defined in claim 1.

In an embodiment of the invention to be described a test body has a tubular transparent casing of a plastics material and tubular bands which extend within the casing towards, but not to the centre of the casing, the tubular bands being made up of sections extending over an arc of revolution about the longitudinal axis of the body and incorporating a radioactive material.

Embodiments of test bodies in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of a test body or test phantom with its lid shown separated, and Figures 2, 3 and 4 are perspective exploded views of elements for insertion in the body shown in Figure 1.

Referring to Figure 1, there is shown at 1 an outer tubular transparent casing of a plastics material, for example Perspex, (Trade Mark) within which there are arranged three sets 2, 3 and 4 of part-quarter segments 5. Each set of segments 2, 3 and 4 forms a distinct tubular band. None of the segments 5 extends to the centre of the assembly and a central tubular region contains a rod 6 having longitudinally extending holes 7, 8 and 9 therein.

The segments 5 are made of a moulded plastics material and the segments of each set incorporate both a colouring material which is distinctive for
that set and a radioactive material which emits
gamma rays, the intensity of the gamma
radiations emitted from one set being of a known
level which is different from that emitted by each
of the other sets. Since each of the segments 5 is
of the same shape, it is possible for one or more
of the segments of one set, having a particular
radiation level, to be interchanged with segments
of one or more of the other sets. As a result of
such an interchange of the segments it is possible
to provide a body whose radiation intensity varies
not only in bands 11, 12 and 13 corresponding to
the original sets 2, 3 and 4, along its length, but
with radiation intensity which varies around the
circumference of each of the bands. It is furthe-
more possible to vary the pattern of radiation
intensity emitted by including one or more seg-
ments 5 which is not loaded with radioactive
material.
Furthermore, by loading into the holes 7, 8 and
9, rods having varying levels of radiation emis-
sion, varying levels of radiation emission
along their length, or emitting no radiation at all,
It is possible to simulate varying degrees of
radiation patterns in which one source of radia-
tion is at a different depth from another in a
particularly simple way.
The rods to be loaded into holes 7, 8 and 9 will
commonly be tubular and made of a solid plastics
material, for example Perspex, loaded evenly
throughout with a radioactive material, for exam-
ple cobalt 60, so that a uniform distribution
of radiation is obtained from the rods.
A modification of this form of rod is shown in
Figure 2 to comprise two similar parts 15 and 16,
of solid plastics material which have respective
flat faces 17 and 18. Each of the parts 15 and 16
includes a recess 19 or 20 in a respective one of
the faces 17 and 18, so that, when the faces 17 and
18 are placed together a rod is created for
insertion into one of the holes 7, 8 or 9 having a
central space formed by the recesses 19 and 20.
The rod which is created in the arrangement of
Figure 2 extends into one of the holes 7, 8 or 9
through only the first set of segments 2. The solid
material of which the parts 15 and 16 are made is
not radioactive and the arrangement shown in
Figure 2 is used by placing a small radioactive
point source element in the central space formed
by the recesses 19 and 20 before the assembly
consisting of the two parts 15 and 16 is placed in
one of the holes 7, 8 or 9 and the test body or
phantom is used for resolution measurements.
Referring now to Figure 3, there is shown a
form of rod constituted by two parts 21 and 22,
similar to the parts 15 and 16 shown in Figure 2,
but having a greater length so that the rod which
is created by placing them together extends
through the three sets of segments 2, 3 and 4. The
parts 21 and 22 each have a series of equally
spaced recesses 23, pairs of which form a series of
spaces each able to contain a point source
element, thereby enabling upon insertion of the
rod into the body a phantom to be provided which
can be used to test both the longitudinal and the
spatial resolution of the array.
Referring to Figure 4, there is shown a hollow
tubular insert 25 of non-radioactive material
having a plug 26. Radioactive liquid of known
strength can be introduced into the tubular insert
25 and retained by the plug 26, thereby providing
a further form of insert for use in a phantom to
enable quantitative measurements to be made.
The present invention enables a number of
different combinations of radiation pattern to be
produced, each of which can be assembled easily
and be used as a standard for testing the per-
formance of apparatus in relation to each of a
number of quite different applications.
It will be appreciated that variations of and
modifications in the embodiments described can
be made within the scope of the present inven-
tion. For example, in the arrangement of Figure 1
the elements to be inserted in the longitudinally
extending holes 7, 8 and 9 can be located on the
lid 10 and be inserted as the lid is hinged onto
the body 1. It will also be appreciated that,
although the segments 5 in the particular embodi-
ment shown in Figure 1 are all similar, it would be
within the scope of the invention to employ more
than one shape of segment. It would for example
be possible to have a segment which extended
over one half of the area of the casing 1 instead of
only one quarter, or a segment which extended
between two of the bands 11, 12 or 13.
Furthermore the outer casing 1, or yet another
separate outer casing, may have an elliptical
cross-section such that it represents more closely
the cross-section of a human being.
Other variations and modifications will be
apparent to those skilled in the art.

Claims

1. A test body for use in checking the perfor-
mance of apparatus which detects the emission of
radiation from a body, the test body including a
longitudinally extending tubular casing, charac-
terised in that there are provided within the
casing (1) two bands (2) (3) incorporating radia-
tion emitting material, each band (2) (3) being
held at a location along the length of the body
which is different from that of the other, being
spaced from the longitudinal axis of the body and
including segments (5) each of which provides an
emission at a known level of radiation intensity,
and each segment (5) extending over an arc of
revolution about the longitudinal axis of the body.

2. A test body as claimed in claim 1 charac-
terised in that the segments (5) of one of the
bands (2) each incorporate a material having one
level of radiation intensity and the segments of
the other band (3) each incorporate a material
having a second level of radiation intensity.

3. A test body as claimed in claim 1 charac-
terised in that segments (5) having one level of
radiation intensity and segments (5) having
another level of radiation intensity are both
arranged in each of the said bands (2) (3).
4. A test body as claimed in any one of the preceding claims characterised in that it includes a longitudinally extending rod (6) incorporating a radioactive material having a known level of radiation intensity.

5. A test body as claimed in claim 4 characterised in that the longitudinally extending rod includes a pair of similar parts (15) (16) of semi-circular cross section, at least one of the parts defining a recess (19) for a radioactive element.

6. A test body as claimed in claim 4 characterised in that it includes a tubular insert (25) for a radioactive liquid within the rod (6).

Patentansprüche

1. Testkörper zur Verwendung bei der Prüfung der Leistungsfähigkeit einer Einrichtung, die die Strahlungsemision aus einem Körper abstastet, wobei der Testkörper ein sich longitudinal erstreckendes, rohrförmiges Gehäuse aufweist, dadurch gekennzeichnet, daß in dem Gehäuse (1) zwei Bänder (2,3) vorgesehen sind, die Strahlung emittierendes Material enthalten, wobei jedes Band (2,3) an einer Stelle entlang der Länge des Körpers gehalten ist, die unterschiedlich ist von derjenigen des anderen, im Abstand von der Längsachse des Körpers angeordnet ist und Segmente (5) aufweist, die jeweils für eine Emission mit einem bekannten Pegel der Strahlungsräntenheit, wobei sich jedes Segment (5) über einen Drehbogen um die Längsachse des Körpers erstreckt.

2. Testkörper nach Anspruch 1, dadurch gekennzeichnet, daß die Segmente (5) von dem einen der Bänder (2) jeweils ein Material mit einem Strahlungsräntenheitspegel und die Segmente des anderen Bandes (3) jeweils ein Material mit einem zweiten Strahlungsräntenheitspegel aufweisen.

3. Testkörper nach Anspruch 1, dadurch gekennzeichnet, daß die Segmente (5) mit dem einen Strahlungsräntenheitspegel und die Segmente (5) mit dem anderen Strahlungsräntenheitspegel beide in jedem der Bänder (2,3) angeordnet sind.

4. Testkörper nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß er einen sich longitudinal erstreckenden Stab (6) enthält, der ein radioaktives Material mit einem bekannten Strahlungsräntenheitspegel enthält.

5. Testkörper nach Anspruch 4, dadurch gekennzeichnet, daß der sich longitudinal erstreckende Stab ein Paar ähnliche Teile (15,16) mit halbkreisförmigem Querschnitt aufweist, wobei wenigstens ein Teil eine Aussparung (19) für ein radioaktives Element enthält.

6. Testkörper nach Anspruch 4, dadurch gekennzeichnet, daß er einen rohrförmigen Einsatz (25) für eine radioaktive Flüssigkeit innerhalb des Stabes (6) enthält.

Revendications

1. Une structure de test prévue pour l’utilisation dans le contrôle des performances d’un appareil qui détecte les radiations émises par un corps, la structure de test comprenant une enveloppe tubulaire s’étendant en direction longitudinale, caractérisée en ce qu’il existe à l’intérieur de l’enveloppe (1) deux bandes (2) (3) contenant une matière qui émet une radiation, et chaque bande (2) (3) est maintenue à un emplacement sur la longueur de la structure qui est différent de celui de l’autre bande, elle est espacée par rapport à l’axe longitudinal de la structure et elle comprend des segments (5) produisant chacun une émission à un niveau d’intensité de radiation connu, et chaque segment (5) s’étend sur un arc de révolution autour de l’axe longitudinal de la structure.

2. Une structure de test selon la revendication 1, caractérisée en ce que chacun des segments (5) de l’une des bandes (2) contient une matière ayant un premier niveau d’intensité de radiation et chacun des segments de l’autre bande (3) contient une matière ayant un second niveau d’intensité de radiation.

3. Une structure de test selon la revendication 1, caractérisée en ce que des segments (5) ayant un niveau d’intensité de radiation et des segments (5) ayant un autre niveau d’intensité de radiation sont disposés dans chacune des bandes (2) (3).

4. Une structure de test selon l’une quelconque des revendications précédentes, caractérisée en ce qu’elle comprend un barreau (6) s’étendant en direction longitudinale qui contient une matière radioactive ayant un niveau d’intensité de radiation connu.

5. Une structure de test selon la revendication 4, caractérisée en ce que le barreau s’étendant en direction longitudinale comprend une paire de parties similaires (15) (16) de section transversale semi-circulaire, et l’une au moins de ces parties définit une cavité (19) prévue pour recevoir un élément radioactif.

6. Une structure de test selon la revendication 4, caractérisée en ce qu’elle comprend un élément rapporté tubulaire (25) destiné à recevoir un liquide radioactif à l’intérieur du barreau (6).