

# PATENT SPECIFICATION

(11) 1 578 754

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- (21) Application No. 11959/76 (22) Filed 25 March 1976  
(23) Complete Specification filed 8 June 1977  
(44) Complete Specification published 12 Nov. 1980  
(51) INT. CL.<sup>3</sup> H05G 1/02  
(52) Index at acceptance  
HSR 10  
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## (54) PATIENT POSITIONING AND SUPPORTING ARRANGEMENT

(71) We, EMI LIMITED, a British company of Blyth Road, Hayes, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to a patient positioning and supporting arrangement for an apparatus which is capable of being used to examine a part of the patient's body by a radiographic technique known as computerised axial tomography. Apparatus for performing computerised axial tomography is described and claimed in British Patent Specification No. 1,283,915.

In essence, computerised axial tomography is performed by measuring the absorption suffered by X-radiation on traversing each of many co-planar, pencil-like beam paths through a body and processing signals indicative of the various absorption values to evaluate the absorption coefficient, with respect to the radiation used, at each of a number of locations distributed over the irradiated plane of the body. The processing is preferably effected without transforming the absorption values out of the spatial domain, and suitable processing techniques are described in the aforementioned British Patent Specification and in British Specification No. 1,471,531. A visual representation of the evaluated coefficients is provided in any convenient manner.

The patient's body must be positioned properly and supported in a suitable manner whilst the examination is carried out, and it is an object of this invention to provide a patient positioning and supporting arrangement for this purpose.

According to the invention there is provided an arrangement for positioning and supporting the body of a patient in relation to a radiographic apparatus, the arrangement comprising a curved platter upon

which the patient can be disposed, a table having a curved groove to accommodate the platter, and means for driving the platter slidably along the groove; the platter being formed of a substantially rigid platform shaped to conform to said curved groove, and a shroud, secured to said platter and disposed, in operation, between the platter and the surface of said groove, so as to permit the platter to slide smoothly in said groove.

In order that the invention may be clearly understood and readily carried into effect, one embodiment thereof will now be described, by way of example only, with reference to the drawings filed with the Provisional Specification of which:—

Figure 1 shows, in perspective view, apparatus incorporating the invention, but does not show the platter,

Figure 2 comprises Figure 2(a) which shows, in side elevation a suitable arrangement for driving the platter, and Figure 2(b) which shows a detailed cross-section on lines B-B of Figure 2(a), and

Figure 3 shows, in perspective view, a platter suitable for use, in accordance with the invention, with the apparatus shown in Figure 1.

Referring now to the drawings, the apparatus shown in Figure 1 comprises a central housing 1, which is formed with an aperture 2, in which a body to be examined can be located, and front and rear couches 3 and 4 respectively which usually remain fixed relative to the housing 1 but are removable therefrom should the need arise.

The housing 1 contains, among other things, a source of X-radiation and a bank of radiation sensitive detectors mounted on a scanning gantry which is capable of executing both translational and rotational scanning movements about the aperture 2. A suitable arrangement of source, detectors and scanning gantry and appropriate

operating procedures therefor is described in detail in British Patent Specification No. 1,478,124 and thus will not be further described herein. However it is stressed that the arrangement disclosed in the aforesaid Patent Specification No. 1,478,124, whilst having been proved in practice to operate well, is not the only arrangement which could be used. For example it may be preferred to utilise a source of spread of X-radiation which substantially irradiates the entire profile of the body in the plane to be examined, together with a correspondingly enlarged bank of detectors, to enable the translational scanning movement to be dispensed with altogether as described in British Patent Specification No. 1,475,303 or to be effected, on a reduced scale, by means of an X-ray tube having facilities whereby the electron beam thereof can be deflected over an elongated target/anode as described in British Patent Specification No. 1,529,799 and 1,558,062. In either event, the only mechanical scanning movement required is a rotational one.

Whichever technique is employed, and in this example it is the one involving both translational and rotational mechanical-scanning movements as described in the aforesaid Patent Specification No. 1,478,124, radiation projected through the body along many co-planar, pencil-like beam paths is detected by the detectors. The absorption suffered by the radiation in traversing each beam path is determined, and the absorption values so determined are processed, for example in accordance with the technique disclosed in the aforesaid British Patent No. 1,283,915 or in accordance with the technique disclosed in the aforesaid Patent Specification No. 1,471,531 to evaluate the absorption coefficient at each of a plurality of locations distributed over the irradiated plane of the body.

The patient's body, as previously mentioned, has to be properly supported whilst the examination is carried out so that a plane of interest in the body coincides with the plane irradiated by the source of X-radiation. To this end, the front and rear couches 3 and 4 are formed with longitudinally extending arcuate grooves 5 and 6 respectively. The flat horizontal surfaces (e.g. that shown at 7) of the couches 3 and 4 are covered with the material covered by the Registered Trade Mark "Formica" having a smooth finish so that they can be easily wiped clean should they be soiled, whereas the faces of the grooves 5 and 6 are covered with "Formica" having a matt finish to provide a well defined coefficient of friction which is substantially constant throughout the length of the grooves.

In the base of the groove 5 in the front

couch 3 there is formed a channel 8 in which is disposed a drive wire (not shown in Figure 1) to which a drive spigot 9 is secured. The drive wire, as will be more fully explained with reference to Figure 2, passes over a pulley at either end of the front couch 3 and back underneath itself to be wrapped around a drum which is driven by an electric motor.

The platter, which will be more fully described with reference to Figure 3, is in the form of a rigid stretcher which is curved to fit the grooves 5, 6. The base of the stretcher is formed, adjacent one end thereof, with a hole into which the drive spigot 9 slots. The platter can then be driven into and through the aperture 2 by means of the drive arrangement just described.

Referring now to Figures 2(a) and 2(b) which show respectively a schematic side elevational view and a detailed cross-sectional view taken on the lines B-B in Figure 2(a), it can be seen that the drive spigot 9 is secured to a cable 10 which constitutes the aforesaid drive wire. The cable is a plastic-covered braided wire cable and is effectively endless; the two ends being joined at the spigot 9. As previously mentioned, the cable 10 runs along the channel 8 in the front couch 3 and passes over a pair of idler pulleys 11 and 12 disposed at respective ends of the couch 3. The cable 10 then passes back beneath the channel 8 and is wound in three turns around a drive drum 13. The drum 13 is driven by an electric motor (not shown) by way of a gearing arrangement. As the drum 13 rotates, it drives a wheel 14 (Figure 2(b)) which, in turn, drives a lead screw 15. Mounted on the lead screw, so as to traverse therealong when the lead screw rotates, is an actuator 16. The actuator 16 also runs on a guide 17 (Figure 2(a)) to prevent it rotating with the lead screw. The pitch of the lead screw 15 is arranged so that, when the spigot 9 is at its closest permissible approach to the idler pulley 11, the actuator 16 contacts the operating member of a micro-switch 18 which disconnects the electrical power to the motor which drives the drum 13, thus preventing further movement of the spigot 9 towards the idler wheel 11. Similarly, when the spigot is driven in the opposite direction, towards idler wheel 12, the actuator 16 approaches a second micro switch 19 (Figures 2(b)); the arrangement being such that, when the spigot has travelled as far as necessary in that direction, the actuator 16 operates the micro-switch 19 so as to disconnect the electrical power to the motor which drives the drum 13.

The platter, which is shown generally at 20 in Figure 2(a), is shown in more detail in Figure 3 and consists of an elongated,

rigid stretcher 21 formed of either laminated "Formica" or wood and shaped to fit the curvature of the grooves 5 and 6. Stretched over the base of the stretcher is a nylon shroud 22 which is secured to the stretcher by means of strips of the material known as "Velcro" (Registered Trade Mark) co-operating with other "Velcro" strips formed on material attached to the stretcher 21 at its ends as shown at 23 and at the sides thereof adjacent the ends as shown at 24. Along most of the length of the stretcher the nylon shroud is formed with flaps 25 and 26 formed with respective "velcro" strips 27 and 28 to which a suitable belt can be secured; the belt being used to hold the patient firmly in the platter, and having "Velcro" strips secured to its ends.

The nylon shroud 22 is similar in appearance to cheese-cloth and has been found to exhibit suitable sliding characteristics on the matt "Formica" finish in the grooves 5, 6. In addition, four strips such as 29 of P.T.F.E. are secured to the underside of the shroud, running longitudinally thereof and extending the full length of the platter. These strips are provided to reduce fraying of the nylon material forming the shroud because of its tendency to ruck and pucker, especially at the commencement of movement of the platter relative to the couches. The P.T.F.E. strips also improve the coefficient of friction between the platter and the couches.

In some circumstances, it may be desired to move the platter 20 incrementally relative to the couches 3 and 4. This can be effected automatically under the influence of one or more graticule discs and suitable photocell/detector arrangements. It is preferred, however, to provide a manually operable incrementing arrangement by means of which the platter is moved incrementally through a predetermined distance in response to the manual operation of a push button. The predetermined distance can be selected from three alternatives, e.g. 5mm, 10mm and 15mm. If several incremental movements are required, the push button has to be operated a corresponding number of times. If neither of the three push buttons is actuated, the platter is automatically moved through a distance of 13mm between scans.

It is preferable for the motor which drives the cable drum 13 to be a two speed motor. This enables a patient originally supported by the front couch 3 to be transported rapidly through the aperture 2 until he is in approximately the desired position for examination, at which time the motor is switched to its lower operating speed to enable the operator to position the body accurately in the aperture 2.

Although they are not shown in the drawings, it is preferable for a number of touch-

sensitive switches to be provided in the aperture 2. These switches can be linked to the controls of the apparatus in known manner so as to inhibit the scanning operation and/or certain movements of the platter should a part of the patient's body contact the housing 1.

Instead of the nylon shroud 22 with its P.T.F.E. strips, it is possible, and sometimes preferable, to use a shroud formed of a material known as "TYGAFLO" 128A/10T" ("TYGAFLO" is a Registered Trade Mark) which is a P.T.F.E. coated glass fabric. This material has a more suitable coefficient of friction with respect to the couches, and has increased resistance to fraying as compared with the nylon shroud referred to previously.

#### WHAT WE CLAIM IS:

1. An arrangement for positioning and supporting the body of a patient in relation to a radiographic apparatus, the arrangement comprising a curved platter upon which the patient can be disposed, a table having a curved groove to accommodate the platter, and means for driving the platter slidably along the groove; the platter being formed of a substantially rigid platform shaped to conform to said curved groove, and a shroud, secured to said platter and disposed, in operation, between the platter and the surface of said groove, so as to permit the platter to slide smoothly in said groove.
2. An arrangement according to Claim 1 wherein said shroud is formed of nylon.
3. An arrangement according to either of Claims 1 or 2 wherein said shroud is formed, on the surface thereof adjacent said table, with at least one strip of poly-tetra-fluoro-ethylene, extending longitudinally of said platter.
4. An arrangement according to Claim 1 wherein said shroud is formed of a glass fabric coated with poly-tetra-fluoro-ethylene.
5. An arrangement according to any preceding claim wherein the base of said platter is formed with engagement means for co-operation with a receptor means which can be driven longitudinally of said table to drive said platter longitudinally along said table.
6. An arrangement according to Claim 5 wherein the drive applied to said receptor means, and thence via said engagement means to said platter, can be

- optionally rendered step-wise or continuous.
7. An arrangement according to any preceding claim including, in fixed relationship to said table, a housing containing the active elements of a computerised tomographic apparatus.
8. An arrangement, substantially as
- herein described with reference to the drawings filed with the Provisional Specification, for positioning and locating the body of a patient in relation to a radiographic apparatus.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.  
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

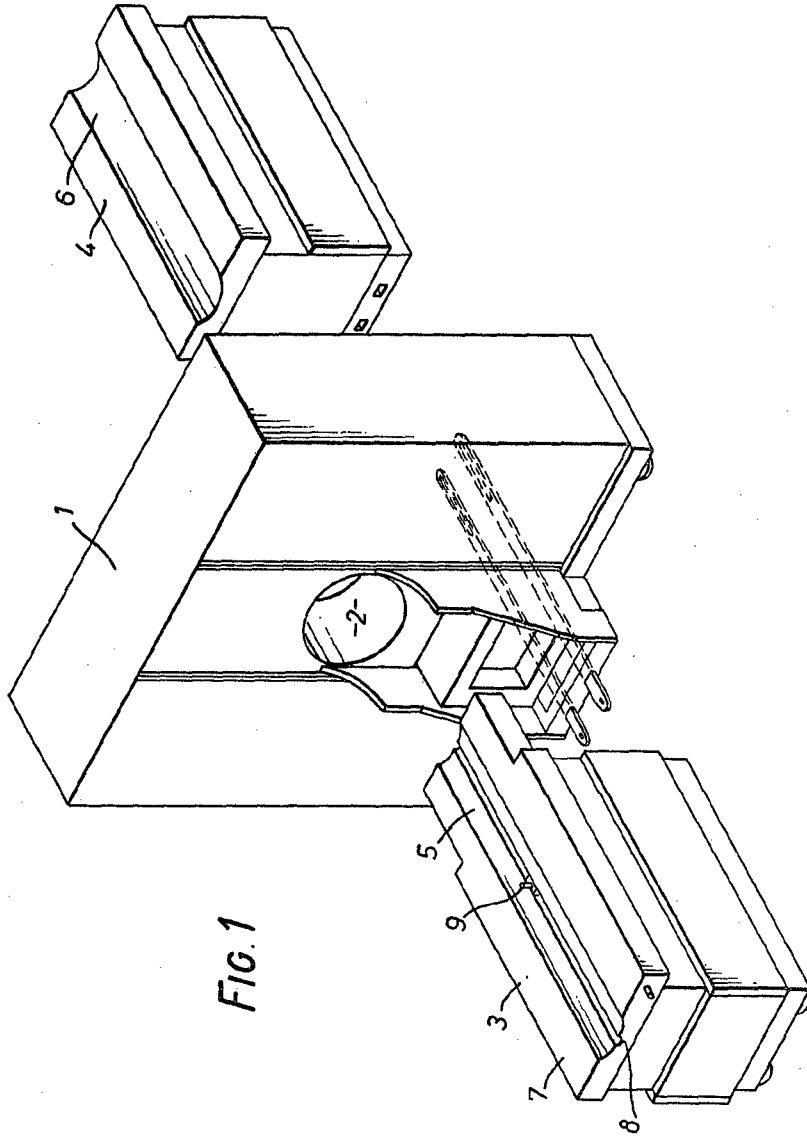


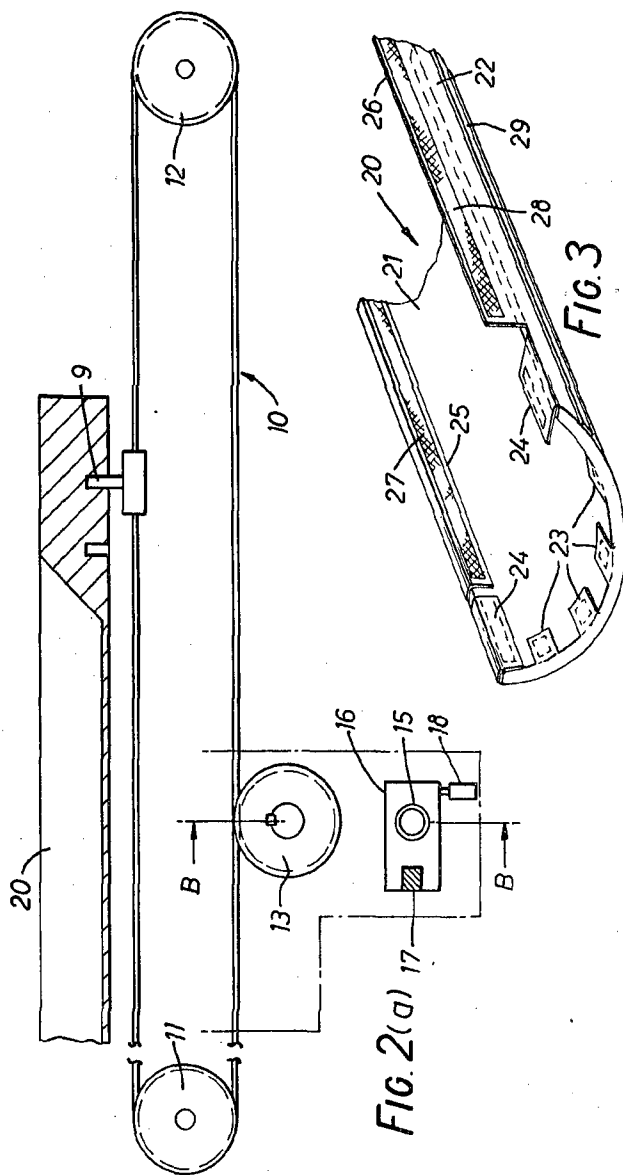
FIG. 1

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PROVISIONAL SPECIFICATION

3 SHEETS

This drawing is a reproduction of  
the Original on a reduced scale  
Sheet 2



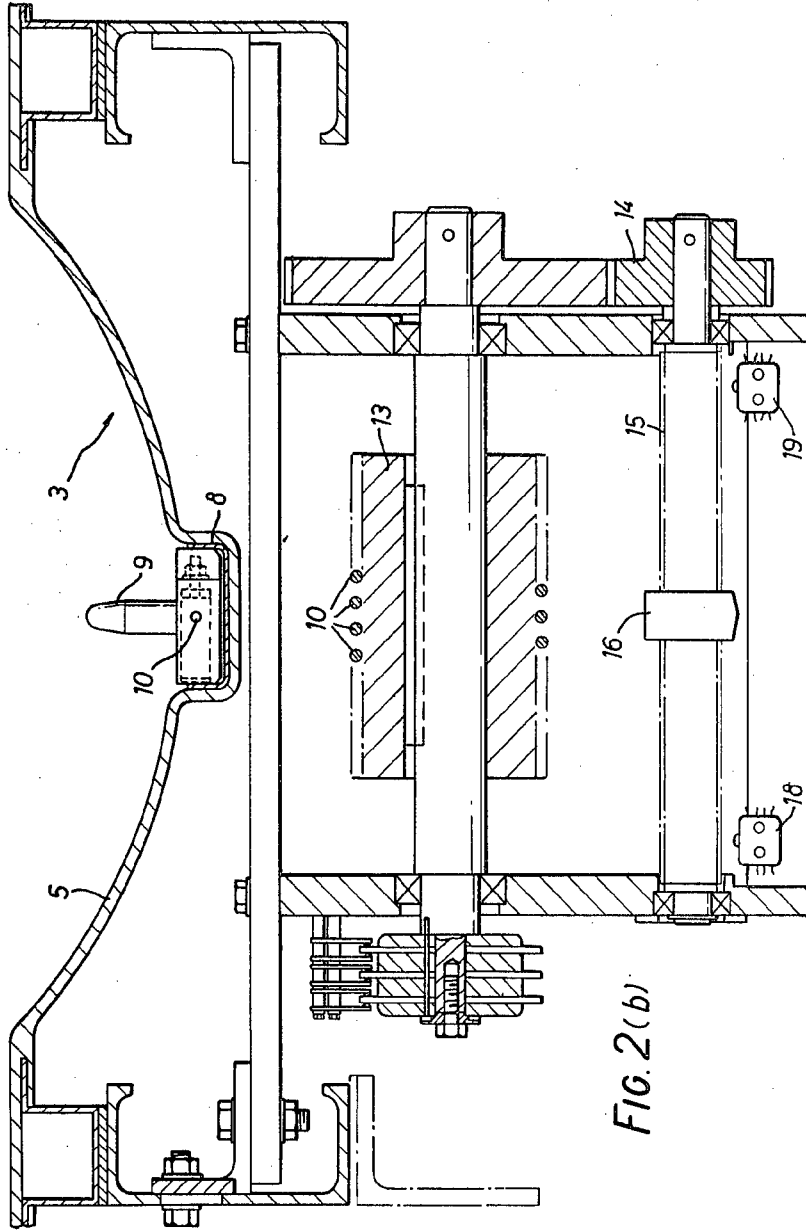


FIG. 2(b)