# A) Apparatus

## Remodeling of the Whole Body Scanner

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Recently, we have made a whole body scanner of a dual probe type, having some newly designed attachments for better handling in daily works.

The probes (5 inches crystal) are vertically opposed and can move for 30 cm on both sides from the center and 190 cm longitudinally. The scan speed can be changed from 20 cm/min to 500 cm/min continueously. The spacing is provided for 1.5, 3.0, 4.5, 7.5, 9.0, 15.0 and 30.0 mm. The recording system is composed of two channels of each dot and photo record. The image ratio is provided for 1/1, 1/3 and 1/5. The scanning table contains X-ray cassette for determining exact localization.

The newly developed attachments are as follows:

1) Program scanning attachment.

The program scanning attachment is designed for the scanning of the area of interest, which results in saving the scanning time. The attachment is composed of photo luminescence diode and photo transister, and attached to one of the dot recording heads. The area of interest is demarcated with black ink on the scintigram paper. When this attachment reaches to the black line, the photo transister recognizes the changes of the brightness of the reflected light on the scintigram paper, which comes from the photo luminescence diode; resulting in advancing the space. Thus, only the area of interest can be scanned without scanning unnecessary area.

2) Display of total counts or counts after rate down.

While the scanning is being done, the total counts or counts after rate down are displayed. This enables us to calculate the activity in the area of interest in combination with the program scanning. This is particularly important to determine the radiation dose to the lesions in treating the thyroid carcinoma with radioactive iodine.

3) Simultaneous recording of profile scan pattern with the scintigram.

While the scintigram is taken, integrated counts from each line are plotted on the recorder chart, offering the more exact profile pattern.

The above-mentioned newly developed attachments are considered to be very useful.

## Automatic R.I. Injector and Remote Controlled Gamma Imaging Table

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In order to reduce the radiation dose to the personnel working in nuclear medicine laboratories, an automatic R.I. injector was devised and reported before. This injector was modified for the convenience of routine works. The source of $^{99m}Tc$ was shielded with lead. The leakage dose was reduced to 20% even nearby handling of the injector. Dose is much more reduced by

remote control. The filling of the R.I. into the syringe in the amount for several patients and the devided injection for each patient are also performable. Mixing of R.I. such as MAA or colloidal suspension and the prevention of air injection can be done with the up and down motion of the injector itself. The speed of injection is 1 c.c. per sec. with a 19G needle.

The surface dose of a phantom containing 5 mCi $^{99m}$Tc in the liver was about 20 mR per hour and the dose 50 cm apart from the source was 1.2 mR per hour, which is not negligible. To avoid this radiation, the remote controlled gamma imaging table was constructed. The range of movement of the table is 28 cm in the X direction and 135 cm in the Y direction. Scinticamera head movement can also be remote-controlled by extending the cable to a distant place. The dose in the working place before the console, 3 m apart from the phantom, was about 0.01 mR per hour.

The table can be turned around by 90° to get rid of the scinticamera stand base during the exchange of collimators.

After taking scintigraphy, the patient without relative movement can be turned around by 90° on the table and radiographed. Thus, the scintigraphed portion can be accurately demonstrated by X-ray films.

## Radioisotope Cardioangiography Synchronized with Cardiac Impulse Using Slow Speed Video-Tape Recorder

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Radioisotope (RI) cardiography is currently used in many large hospitals, but because of its relatively poor diagnostic accuracy, it is not employed as widely as it might be otherwise. This is generally due to the rapid cardiac movement which results in relatively unclear image. This study was designed to develop an apparatus capable of reproducing required phases of the cardiac cycle using small quantities of RI and at the same time yielding an image of good diagnostic quality.

**Method**

Contrary to the programming of the scinti-photo cardiograph, the scinti-camera output was digitalized and the pulse modulation of the ECG simultaneously recorded on a video-tape recorder's (VTR) image and sound tracks. Slow speed reproduction, is the most advantageous feature of our apparatus. The ECG's R wave activates two delay circuits, the delay time of which can be pre-set, and any phase of the cardiac cycle freely selected. The output controls the scinti-camera.

**Results**

Since our apparatus can reproduce the VTR recordings at slow speed, rapid cardiac beats can be recorded, at desired phases of the cardiac cycle at rates varying from 1 pulse for every 2 frames to 4 pulses per frame on 35 mm film. It has thus proved effective in studying abnormalities appearing only at certain phases of the cardiac cycle. By reproducing the VTR analyses of findings may be conveniently made at any time. The rate of technical accuracy using serial 35 mm photofluorography is less than 25% because of the time required for shutter operation and film advancement. Our slow reproduction system permits relatively fast camera action and a rate of technical accuracy over 90%. This also permits a corresponding reduction in quantity of