nm/PRELIMINARY NOTE

A HYDRAULIC POSITIONING BED FOR RADIOISOTOPE IMAGING

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Being dissatisfied with the methods and equipment for positioning and immobilizing patients, the author has constructed a scanning bed that has the following features: a comfortable supporting surface that assumes the body contour; complete accessibility of a detector to all parts of the body from below; independent elevation of the head and foot ends of the bed; ability to tilt the bed to either side; ability to flex or extend the patient at the hips and the neck-shoulder region; ability to place the entire saggital plane of the patient parallel to the scanning plane to allow complete symmetry in bilateral scans; ability to elevate the patient high enough to allow scanning from below with single-probe scanners (to do this it is necessary to modify the mounting mechanism of the scanner detector); and easy control and powered operation of all bed movements.

CONSTRUCTION AND OPERATION

The mechanical principles of the bed are illustrated by the line diagram of Fig. 1. Its actual construction and use are shown in Fig. 2. Because of the requirement that there be no obstructions beneath the patient, all support and driving mechanisms are at the ends, and the bed is heavily constructed of welded steel. It weighs approximately 600 lb but rolls easily on the floor with ballbearing, swiveled casters. The overall dimensions are: length, 102 in.; width, 25 in.; height, 74 in. The bed frame is in three sections to allow any useful angulation at the hips or neck-shoulder region. The head and foot sections are well trussed to prevent inward collapse of the frame when strung with plastic tubing and bearing the weight of a patient.

The power unit, located in an enclosure at the head end, is a reversible ⅓ HP motor driving a reversible pump. The operator can retract or extend the rod of any chosen hydraulic cylinder by connecting the cylinder to the ports of the pump with a selection lever. A double throw momentary switch is pressed in the desired direction and motion stops on release. The cylinder selection lever turns two directing valves linked by gears and enables the pump to be connected to any of the five cylinders.

Cylinders C_3, C_4 and C_5 move up and down with the end plates and are connected with flexible hose to stanchions at each end of the bed. These minimize the length of flexible hose needed to allow a full range of movement of each plate. The circuit of each cylinder has double lock valves to prevent sinking and a needle valve to adjust the excursion rate.

ADVANTAGES AND USEFULNESS

Comfort. During the year that this device has been in use, several improvements have been noted. Patients seldom complain or move. There is a tendency for the patient to settle into the middle of the supporting surface, and the sling effect tends to remove the urge to squirm. Restraints are needed much less frequently than before the bed was available. Except in psychotic patients sedatives and narcotics have never been needed.

Use with dual-probe scanners. In this laboratory a Picker dual-probe scanner is used mainly for brain, lung, liver and bone scans. In brain scans the simultaneous anterior and posterior views are made with the head somewhat elevated. The bed allows the lower probe to obtain good exposure of the posterior fossa. Good symmetry is attained in lateral views. The plastic tubing supporting the patient has enough "give" to accommodate the right shoulder in a comfortable pocket, and the lower probe can scan well below the base of the brain without touching the shoulder.

In lung scans of patients with orthopnea it has always been possible to elevate the head enough to relieve the distress and yet get a good scan. On lateral views of the lung, adjustment of the head and foot angulation allows excellent symmetry not attainable on a flat surface. With liver and bone scans the chief advantages are comfort and the ability to relieve orthopnea.

Modification of single-probe scanners for views from below. With Picker Magnascanners the detector probes cannot be quickly rotated to scan from below because of obstruction by the rack and pinion mechanism which is ordinarily used to alter the elevation

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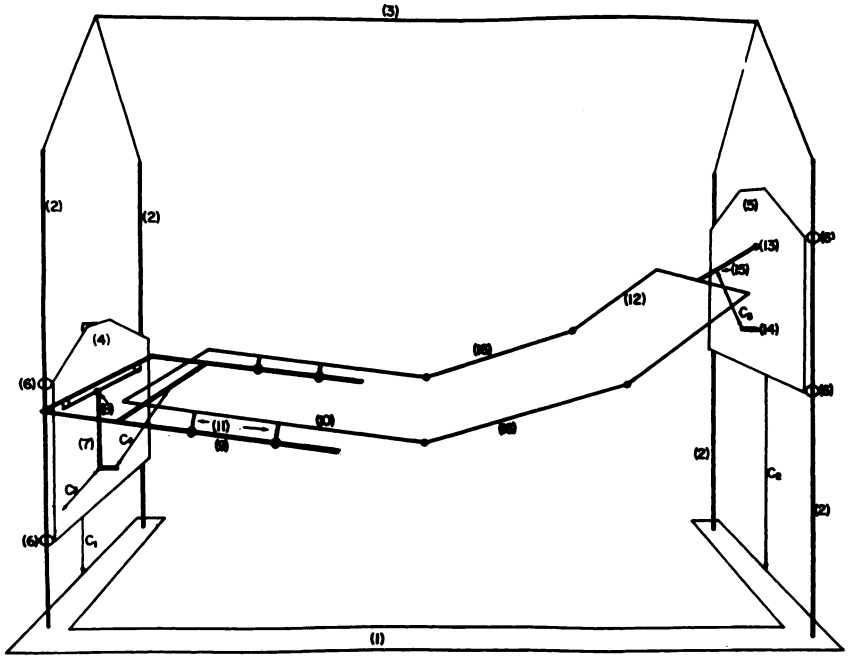

FIG. 1. Mechanical principles of scanning bed. (1) Frame of rectangular tubing; (2) columns supporting the vertical traverse of bed; (3) supporting member for tops of column; (4) foot end-plate; (5) head end-plate; (6) bronze bearings to allow vertical motion of plates; (7) T-shaped piece with a lower shelf to support a hydraulic cylinder and roller bearings at extremities to allow rotation about thrust-bearing pivot (8); (9) U-shaped member hinged to (7) to allow angulation of foot section of bed frame; (10) foot section of bed frame with roller yokes (11) to allow longitudinal motion on (9); (12) head section of bed frame attached to plate with spherical bearing (13); (14) hydraulic cylinder support; (15) spherical bearing; (16) central section of bed frame. Hydraulic cylinders: C_1, elevation of foot end; C_2, elevation of head end; C_3, lateral tilt; C_4, foot end angulation; C_5, head end angulation.

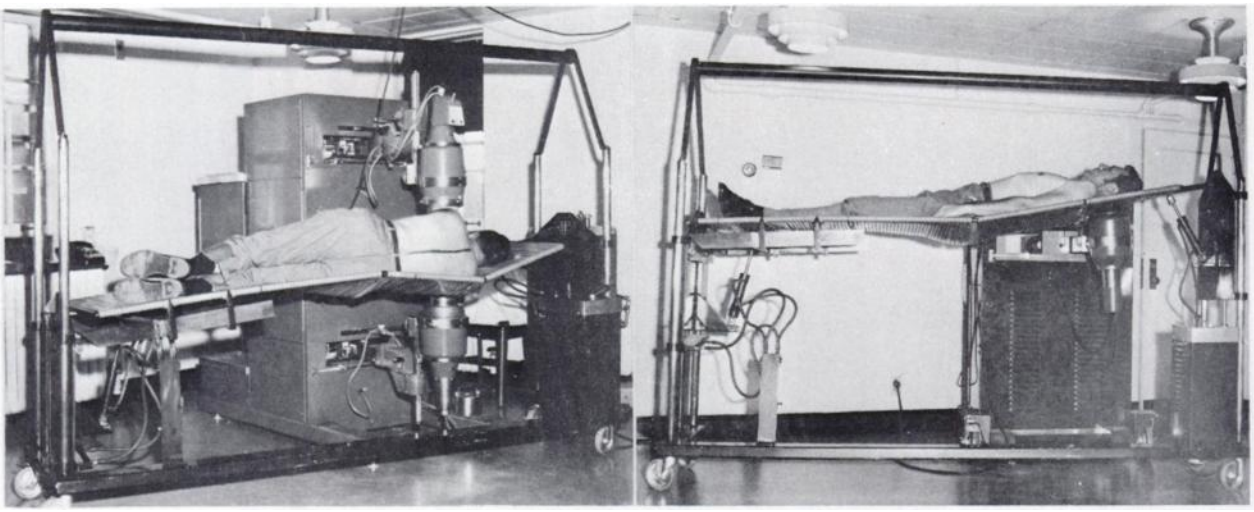

FIG. 2. Scanning bed in use with dual- and modified single-probe Magnascanners.

of the detector. The housing was removed and the probe, constructed in this laboratory (*1*), was mounted to a bar extending through two bearings in the scanning beam. The outer bearing is slit and can be tightened on the shaft by a screw and lever. Standard probes can be similarly mounted.

Other potential uses. Although the bed has been used only with single- and dual-probe Magnascanners, it will accommodate the detector system of nearly all commercially available imaging devices including scanners of other manufacture, cameras and Autofluoroscopes. Exceptions are those instruments that have a scanning surface or table as an integral part. Because of the complete and unencumbered access to all parts of the body, the bed would seemingly be ideal for time studies such as renograms and studies of circulation dynamics.

Cost. The cost of materials for this bed was approximately $1,500. Labor costs cannot be easily estimated, the entire unit having been built by the author.

SUMMARY

A uniquely versatile, hydraulically operated positioning bed has been constructed for radioisotope imaging. Its use has resulted in greatly improved results with scanning and virtual elimination of patient discomfort.

ACKNOWLEDGMENT

An application for a patent on this device was submitted to the U.S. Patent office on September 5, 1969.

REFERENCE

1. BUCHANAN, D. L.: Brain scanning with 200 microcuries of ^{203}Hg-chlormerodrin. *J. Nucl. Med.* **5**:859, 1966.