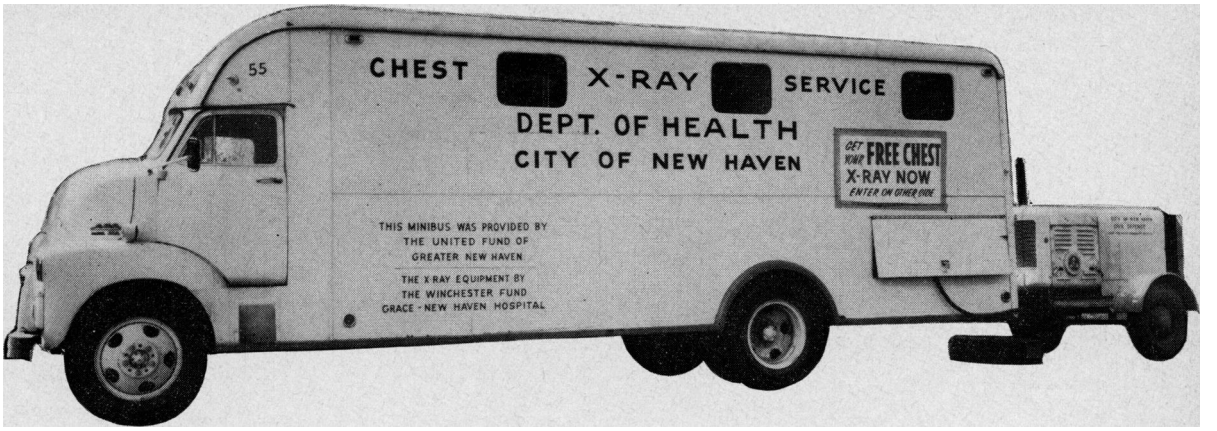


*Figure 1. Minibus with gasoline-driven trailer-generator; entrance and exit doors are on opposite side.*

# CHEST X-RAY VAN ADAPTED FOR SCREENING IN A SURVEY OF JOINT DISEASES

**Roy M. Acheson, D.M., Sc.D., Arthur Clemett, M.D., Frances George, R.N., M.S.N., Carol Ann Kolakowski, M.A., Margaret Payne, M.B., and Joan Vicinus, M.A.**

IN NEW HAVEN, Conn., a Minibus and mobile electrical generator, loaned by the city, were equipped and used in an epidemiologic survey of debilitating joint disease (fig. 1).

The vehicle was originally equipped for taking 70-mm. chest X-rays with a Fairchild Odelca camera. Throughout the time the bus was used in our study, it was in continuous service in a chest X-ray program in New Haven and surrounding areas sponsored by the Tuberculosis and Health Association. It was therefore essential that our adaptation of the bus should not interfere with the regular function of taking chest X-rays.

*Dr. Acheson is director of the survey and professor of epidemiology at Yale University. Dr. Clemett is associate professor of radiology at Yale. Miss George, Mrs. Kolakowski, Dr. Payne, and Mrs. Vicinus are survey staff members.* *The study was supported by contract SAR/PH 86–63–153, Arthritis and Diabetes Program, Division of Chronic Diseases, Bureau of State Services, Public Health Service. Grants for purchasing equipment were received from the New Haven Foundation, the Crippled Children's Aid Society, and the Connecticut Diabetes Association.*

## Equipping the Bus

The only structural modifications of a semipermanent nature which were made in the bus were the installation of the control panel and upright column for the portable Picker 1656 B X-ray machine and of studs for a portable centrifuge.

The bus is divided into three compartments (fig. 2). When it is used for chest X-rays, one

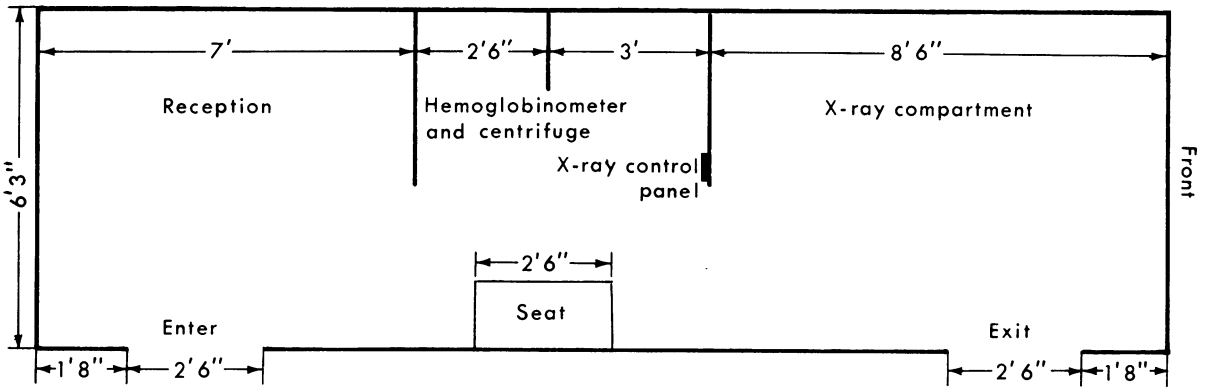


**Figure 2. Floor plan of minibus**

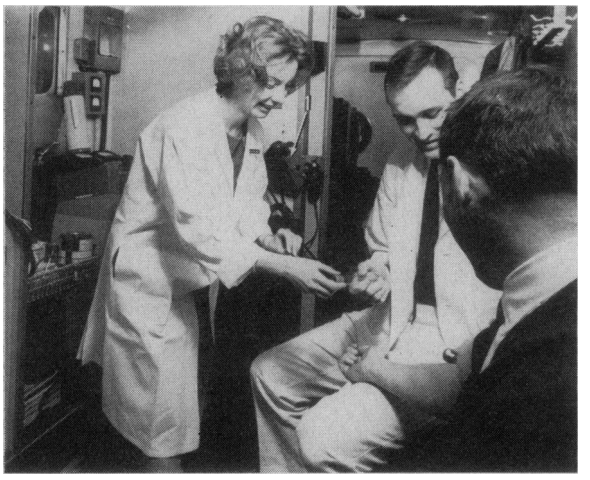

**Figure 3. Central compartment with X-ray control panel (1)**

of these serves for reception, one for the X-ray technician, and the third, which is divided from the second by a lead-lined partition, contains the chest X-ray equipment. In our adaptation we retained the first compartment for its original purpose. We installed the control panel for the X-ray equipment in the second; also in this compartment where a physician, aided by a technician, drew blood, were the hemoglobinometer and centrifuge (figs. 3, 4). In the third compartment the stand for the portable X-ray machine was secured by screws to the floor, and wired to the roof (figs. 5, 6).

A special radiographic "cone" with a rectangular base was constructed for the portable X-ray. Two set positions for the X-ray tube were used so that the tube film distance was main-

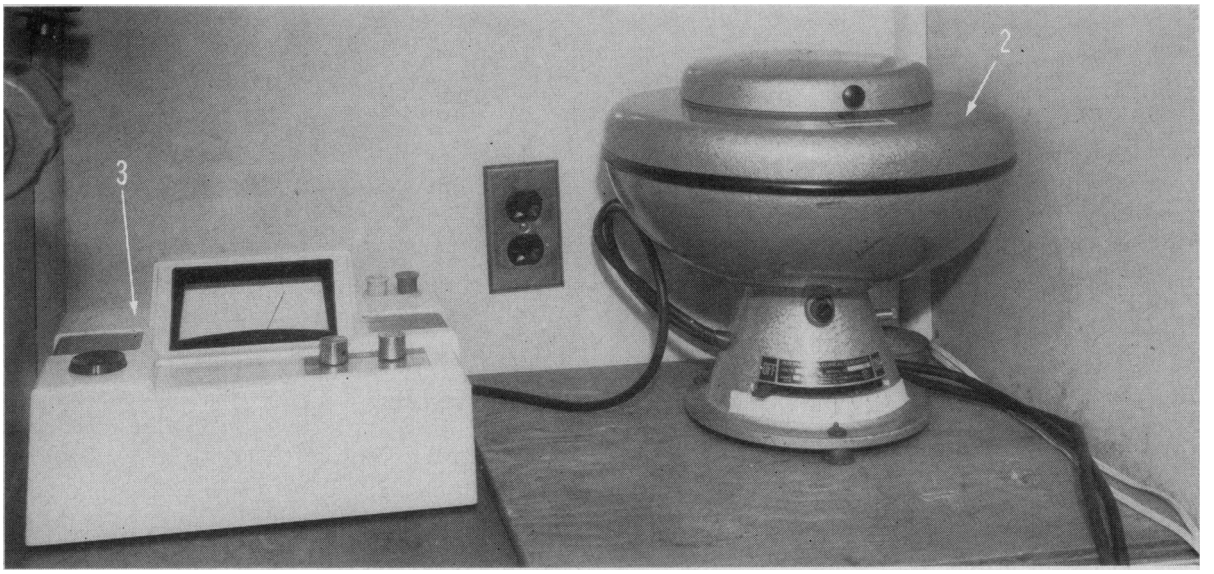


**Figure 4. Installation of hemoglobinometer (3) and centrifuge (2). Both can be removed.**

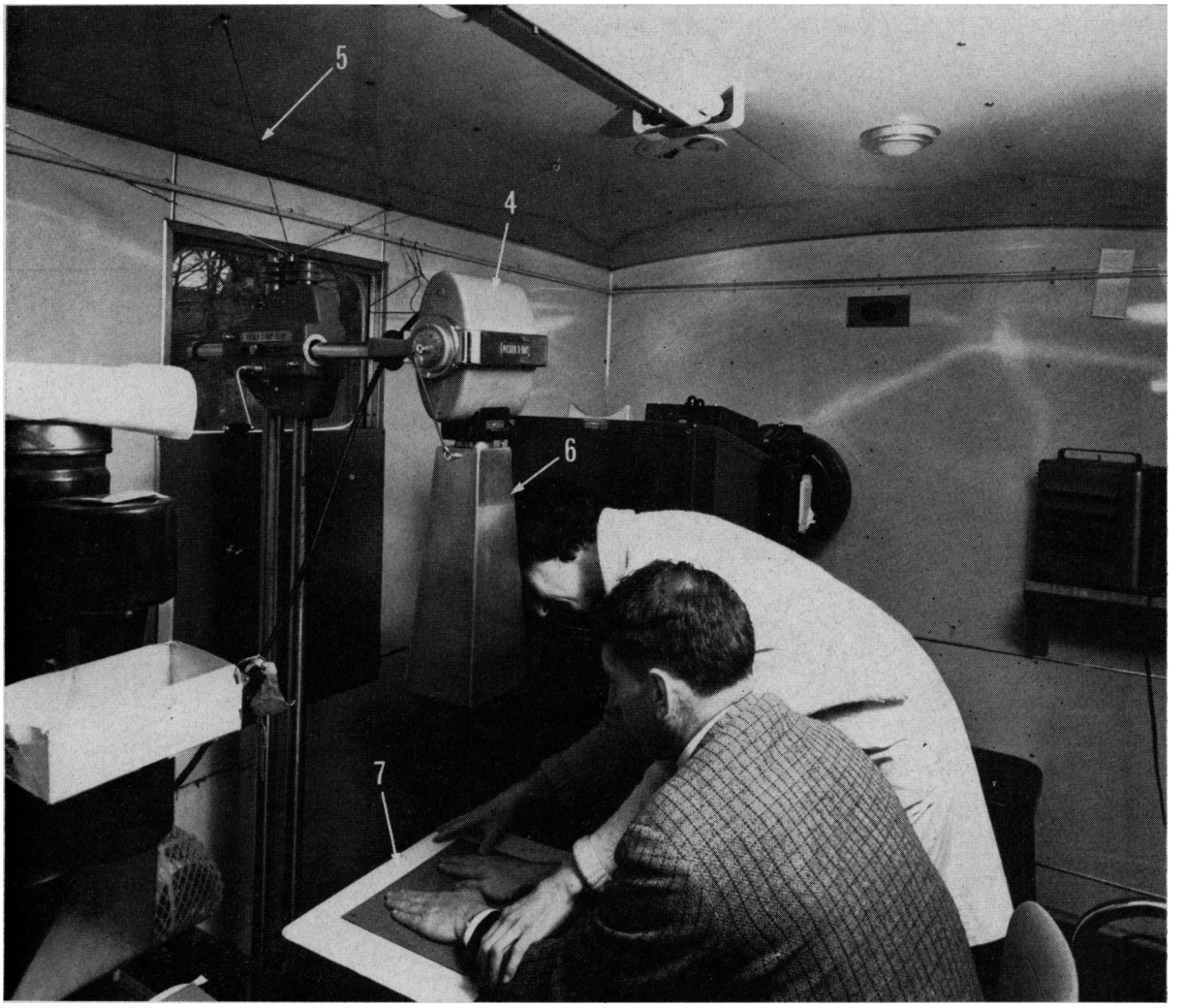


**Figure 5. X-ray tube in position for radiographing hands. Wires securing column to ceiling (5), special cone (6), and tube at top of column (4)**

tained constantly at 40 inches. For hand examinations, the tube was at the top of the column, and the hands rested on a movable table with wheels. For foot examinations the table was rolled away and the tube moved to its lower position. X-rays were taken at 40 kilovolts with 21 milliampere seconds for the hands and 28 milliampere seconds for the feet. Nonscreen film was used to give maximum bone and soft tissue detail. Care was taken to reduce radiation scatter to a minimum.

When the bus was to be used for the joint diseases survey, the arm and tube of our X-ray machine were installed. Other portable equipment included a chair for respondents on reception, one for sitting while being X-rayed, one for sitting to replace shoes after X-rays, and a stool for the physician drawing blood samples. The total cost of purchasing and installing the X-ray tube and the other portable articles in the bus was less than $2,500.

The X-ray film was stored on the floor behind the partition in the second compartment. Blood was stored in a portable rack which was placed on top of the control panel for the chest X-ray unit.

### Protection Against Radiation

All pregnant women and other respondents who desired it wore a lead apron. Careful screening by the staff of the physics department

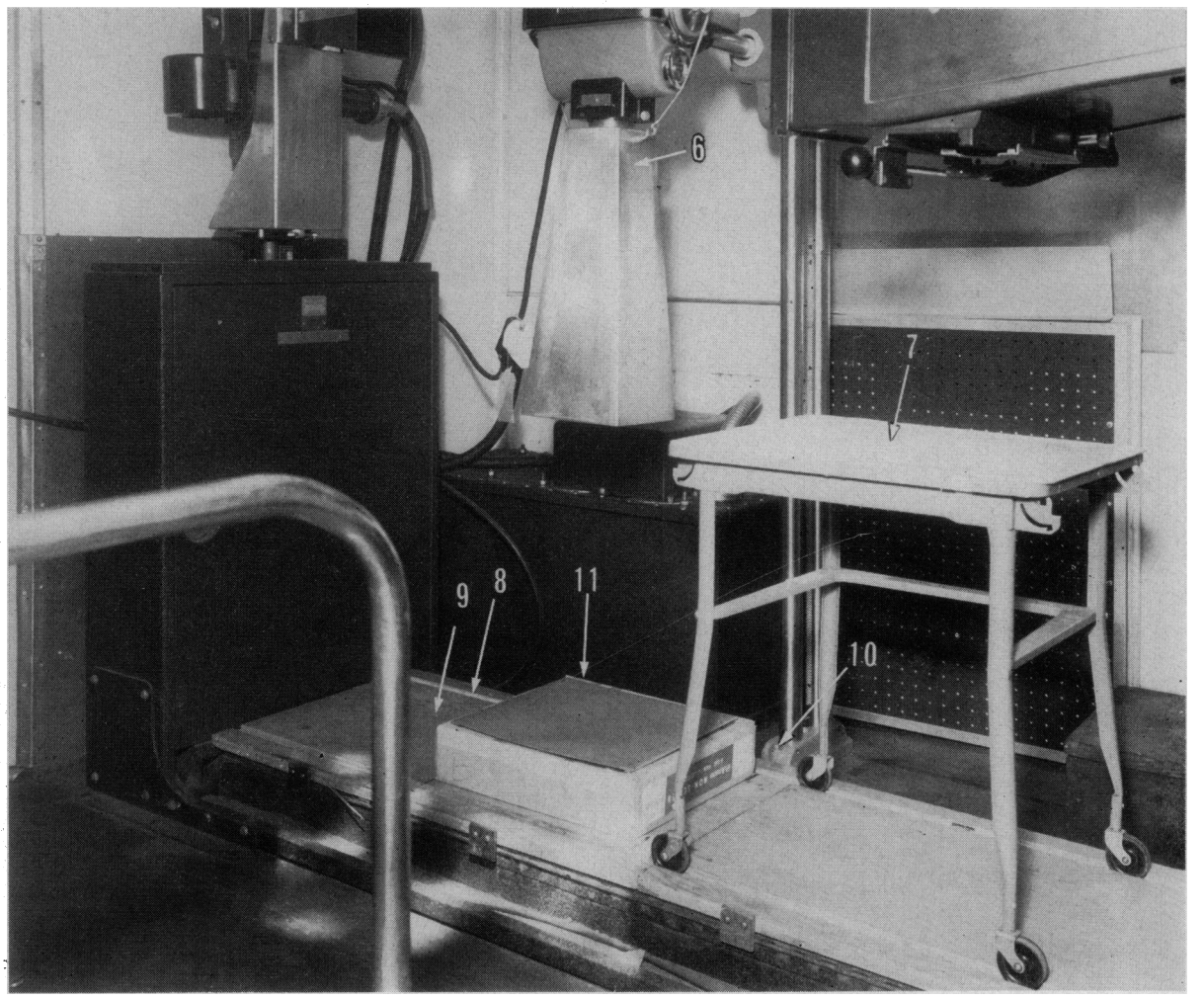


**Figure 6. Equipment in position for X-raying feet. Movable table (7) runs in grooves (8) cut in a portable piece of plywood (9); the tube has been lowered to maintain a tube film distance of 40 inches. Screws (10) fasten column to floor. The respondent's feet are placed on a box with lead sheeting (11).**

of Yale University had shown that radiation scatter was well below the minimal levels stipulated by the Atomic Energy Commission. The total dose to the trunk of the respondents was less than 1 milliroentgen for both exposures, and the maximum detectable scatter in those parts of the bus where the survey staff worked was 3 to 4 milliroentgens per hour of X-ray exposure. All team members wore X-ray safety badges.

Investigation of the epidemiology of debilitating joint disease and certain aspects of diabetes was the primary purpose of this survey. The sample population, stratified by socioeconomic status, consisted of about 2,500 persons 21 years of age and over. They were divided into 5 groups of 500 persons each who lived in 6 discrete areas of the city.

The sample was enumerated by personal interview in the respondent's home. Two or three days before the bus was scheduled to visit a neighborhood, interviewers talked with respondents explaining the aims of the survey and completing questionnaires which were concerned with symptoms of joint diseases. During the interview an appointment was made for the respondent to visit the bus. The entire procedure, venepuncture and radiography, was completed in about 7 minutes providing the respondent arrived promptly for his appointment.