Simplified Planigraphic Tube Motion

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The increasing importance of sectional radiography (planigraphy) of the chest and other body areas makes it desirable to extend its availability in clinical practice. Well-designed attachments avoid the high cost and extra space requirement of special equipment and further the application of this valuable diagnostic facility.

The widespread impression that angulation of the tube during its travel is essential to good planigraphy (*1–3*) has restricted the adaptation of many x-ray machines for such purpose. The writer's original planigraph attachment (*4*) was designed to test the justification of this theory. For this purpose a comparison was made of three types of rectilinear tube movement (Fig. 1).

A fourth type of x-ray tube movement, commonly used in some countries (*5*), is that in which the tube both angulates and arcs. This motion was included in the above comparisons, but is not discussed separately since it produced a picture which did not differ from that obtained by merely arcing the tube (Fig. 1 *C*).

To compare the thickness of the planigraphic sections produced by each of the tube movements shown in Fig. 1, a fine copper wire screen was mounted at a 45° angle, on a balsa wood block (Fig. 2 *A*). As a standard for comparison, an ordinary roentgenogram of this copper wire was first obtained (Fig. 2 *B*). Sectional roentgenograms of the wire screen were then made by each of the methods shown in Fig. 1. This amplitude of x-ray tube movement was automatically controlled by an electrically synchronized motor drive. With a 15-in. tube travel all three types of tube movement produced a focal plane thickness of approximately 2 mm (Fig. 2 *C*).

The letters designating the sectional roentgenograms in Fig. 3 correspond to the x-ray tube movements (Fig. 1) by which they were obtained. Taken at the same level through a patient's chest, all three planigrams may be seen to be of equal diagnostic value. Experimental studies and a comparison of such clinical results failed to demonstrate any advantage in angulating the tube during its travel.

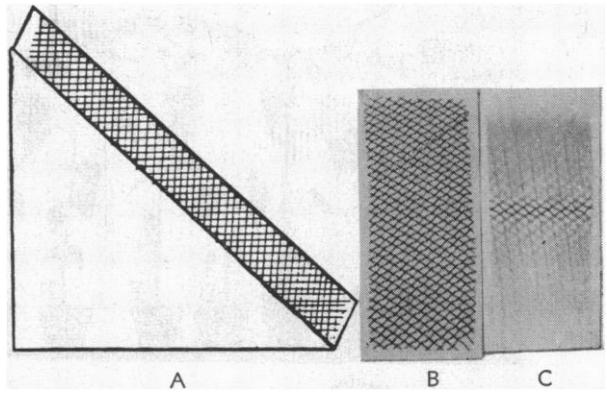

FIG. 2. *A* represents a 45° angle block on which a copper wire screen has been secured to demonstrate the thickness of planigraphic sections obtained by the tube and film movements shown in Fig. 1. At such an angle the wire boxes of which this screen is comprised, measure approximately 1 mm in their vertical diameter. *B*, a conventional roentgen picture of the 45° angle copper screen. It was x-rayed at the same distance and with the same exposure factors used for its subsequent planigraphy. *C*, a planigram of the same copper wire screen obtained with a 15-in. amplitude of planigraphic tube movement and without angulation of the tube (Fig. 1 *B*). The thickness of the resulting planigraphic section, indicated by the sharply focused segment of wire screen, is approximately 2 mm. The uniformly progressive blurring of the copper wire on either side of the focal plane may also be noted.

It may further be noted from Fig. 4 *A* that in customary methods of planigraphy, represented by Fig. 1 *A*, only negligible angulation of the x-ray target occurs during short ranges of tube movement.

The difference in appearance of the cavity in Fig. 3 *C* as compared with 3 *A* and 3 *B* is probably due to some convexity in the plane recorded by arcing the tube (Fig. 1 *C*). This difference, however, is without practical significance, since it is a consistent variation and does not interfere with segmental localization of pulmonary disease or other diagnostic conclusions. Furthermore, the degree of planigraphic curve or convexity which results from merely arcing the x-ray tube is negligible, as shown by additional

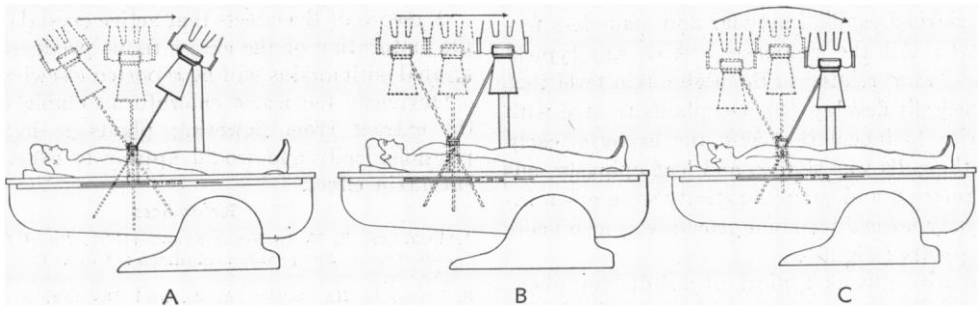

FIG. 1. The three types of rectilinear tube motion compared in this study. *A*, customary planigraphic movement which involves angulation of the x-ray tube. *B*, the simplified planigraphic movement which eliminates tube angulation. This drawing shows extension of the tube travel beyond the range of x-ray film exposure. This must not be construed as evidence of ineffectiveness. The range of x-ray exposure is proved adequate by Fig. 2 *C* and Fig. 3 *B*. Fig. 3 *C* shows a simplified tomographic (arcing) movement, without concomitant angulation of the x-ray tube.

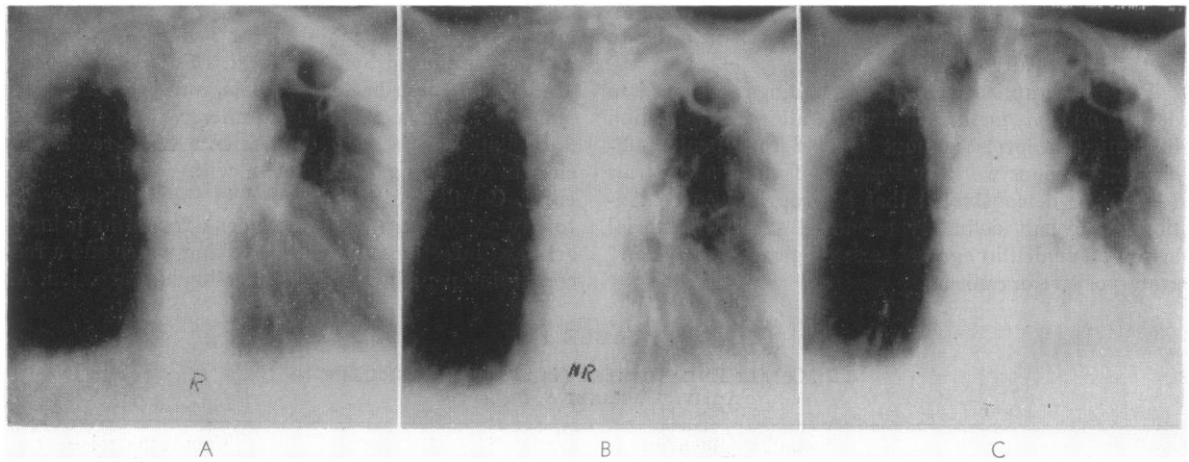

FIG. 3. These sectional roentgenograms of the chest were taken in the anteroposterior position, 9 cm from the table surface and centered at a 36-in. target to film distance. The tuberculous cavitations shown in the left upper lung offer an opportunity for clinical comparison of the planigraphic movements described. These pictures were obtained by the corresponding x-ray tube motions illustrated in Fig. 1.

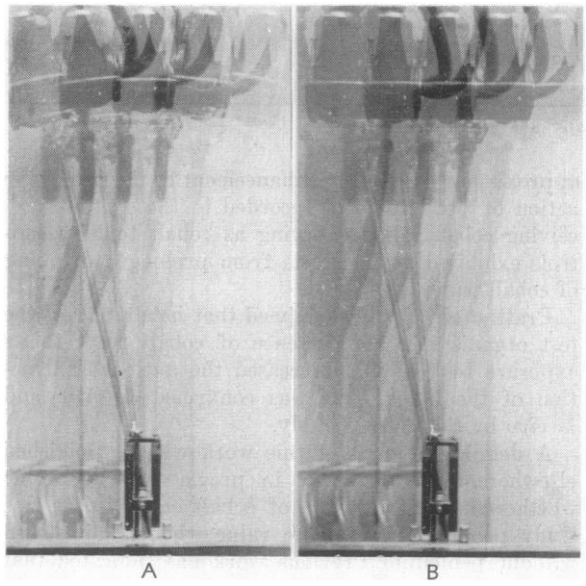

FIG. 4. Serial photographs show the slight degree of angulation in x-ray tube portal which occurs during 15 in. of planigraphic movement. *A*, customary type of rectilinear tube movement used in sectional radiography (corresponds to Fig. 1 *A*); *B*, simplified nonangulating x-ray tube motion illustrated for comparison (corresponds to Fig. 1 *B*).

tests with a 14-in. length of "hardware cloth" (½-in. wire mesh). In fact, the arcing tube motion conforms to the contour of many organs such as thorax, lungs, heart, and skull. Since sectional roentgenograms obtained by the simplified tomographic motion (Fig. 1 *C*) have been proved satisfactory, this type of x-ray tube movement can be recommended as a means of extending planigraphy to the Trendelenburg and semiupright positions and as a means of adding stability to some types of x-ray equipment when used for planigraphy in the upright position.

It may be concluded from the above studies that planigraphic movement can be simplified by utilizing short amplitudes of x-ray tube motion and by eliminating x-ray tube angulation, and that this can be accomplished without sacrificing diagnostic quality or the ability to obtain sharp, thin radiographic sections. As a result, many x-ray machines previously considered unsuitable can now be adapted to sectional radiography.

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Observations on the Cobalt Enhancement of Penicillin Activity Against *Salmonella pullorum*[1, 2]

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In vitro experiments were conducted to evaluate the effectiveness of several antibiotics against *Salmonella pullorum*[4] (the causative agent of pullorum disease in chicks). During the course of routine sensitivity determinations, penicillin at moderately low concentrations was found to exert a slow bactericidal action against this organism. Preliminary *in vivo* studies revealed, however, that penicillin preparations[5] had to be in-

[1] Journal Article No. 1405 of the Michigan Agricultural Experiment Station.

[2] In part, excerpts from thesis of the senior author presented June 1952 to the School of Graduate Studies of Michigan State College, in partial fulfillment of the requirements for the Ph.D. degree.

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[4] Strain #89817 (Poultry Pathology Laboratory, Michigan State College) was used in all experiments.

[5] Penicillin G (buffered potassium salt). Supplied through the courtesy of the Upjohn Company, Kalamazoo, Mich.