FROM THE ROENTGEN DEPARTMENT (DIRECTOR: PROF. ERIK LINDGREN), SERAFIMER-LASARETTET AND THE RESEARCH LABORATORY OF ELEMA-SCHÖNANDER AB, STOCKHOLM, SWEDEN

MIMER

by

G. Fredzell and *E. Lindgren*

The progressive development of apparatus and equipment for use in roentgen examinations has in general followed two main lines, one representing equipment for fluoroscopy from different angles with added facilities for the exposure of films, with or without spot film devices, and the other covering apparatus for examinations which do not as a rule require fluoroscopy, i. e. most skeletal examinations. The variations in design and construction are greater among the units ranged in the first mentioned group than in the latter, although the present industrial trend to manufacture in series may contribute towards equalizing the individual demands of roentgenologists. If tomography equipment is excepted, units for skeletal examinations show more uniformity and simplicity of design but do not as a rule permit of precision in projection. It is in fact surprising to find from textbooks for radiographers, and similar literature, how often authors appear to ignore the means of obtaining a satisfactory demonstration of anatomic detail. The highest degree of accuracy in the directioning of the central ray in relation to the object to be examined is necessary for a clear rendering of a given anatomic detail and for ensuring the possibility of reproducing exactly the same projection at a later occasion. This is essential for a comparison of roentgen views from different examinations and for an evaluation of any changes in a pathologic condition.

Submitted for publication 3 November 1959.

The requirements just mentioned are without doubt of particular importance in connection with roentgen examinations of the skull. It is a fact that the only unit which can be regarded as meeting these demands is the so-called 'skull table' designed by LYSHOLM (manufactured by Schönanders), the prototype of which was described in 1925. It was originally intended for the roentgen examination of the nasal sinuses and auditory cell system but was modified in 1931 and then adapted for examinations of the entire skull. The application of the basic theoretical principles resulted in a construction which in practice left much to be desired; in fact, the unit did not correspond to the original intentions. This was on the other hand the case with the new model which was put on the market in 1935 and which today, after 25 years, retains the same general appearance. This is a long period for a roentgenographic unit and indicates that the fundamental principles of the design were sound and that the construction had been so carefully worked out that no significant improvements had been considered necessary. Another indication of the suitability of the unit is the fact that the original design has been copied, more or less openly.

As the name indicates, the skull table was originally intended for examinations of the bones of the skull, but is used with advantage for the examination also of other skeletal parts, as well as for arthrography. When ventriculography became a routine procedure the skull table was found particularly valuable also for such examinations. The rapid development of ventriculography under the direction of LYSHOLM was essentially made possible by the facilities afforded by this unit of producing accurately the various projections in different planes which were required. In modern neuroradiologic procedures, however, encephalography and angiography prevail, and in these examinations there are undoubtedly certain inherent disadvantages connected with the use of the present skull table.

We have for a long time felt the need for a new unit which, without neglecting the basically sound principles of the original design, would better correspond to requirements arising in modern neuroradiologic work. As, however, the relative amount of neuroradiologic work in many hospitals is not very large, it seemed expedient to attempt to achieve a design which would be well suited for carrying out other types of roentgen examinations as well. Another factor to be kept in mind was that no satisfactory device for the delicate handling of severely injured patients during roentgen examination appeared to exist. The filling of this gap was therefore our further aim. Various technical solutions have been put to trial, and many small as well as full size models have been tried out in practice before a construction satisfying our demands was achieved.

The new diagnostic roentgen unit, which we call Mimer, is fitted with a roentgen tube which can be freely rotated and directed onto any point on a spherical surface with a radius of 80 to 90 cm (Fig. 2). The centre

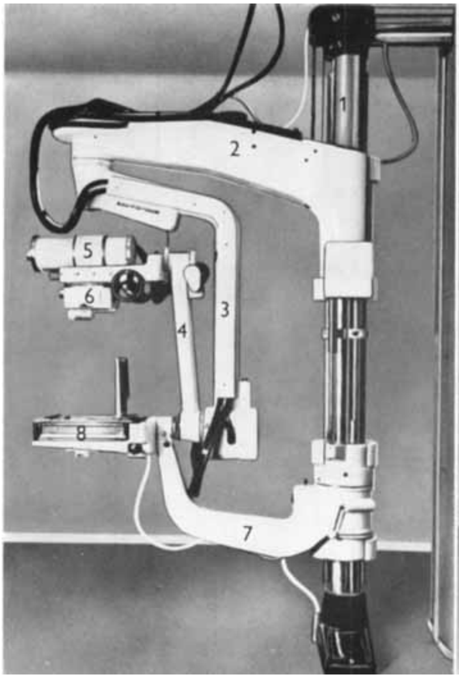

Fig. 1.

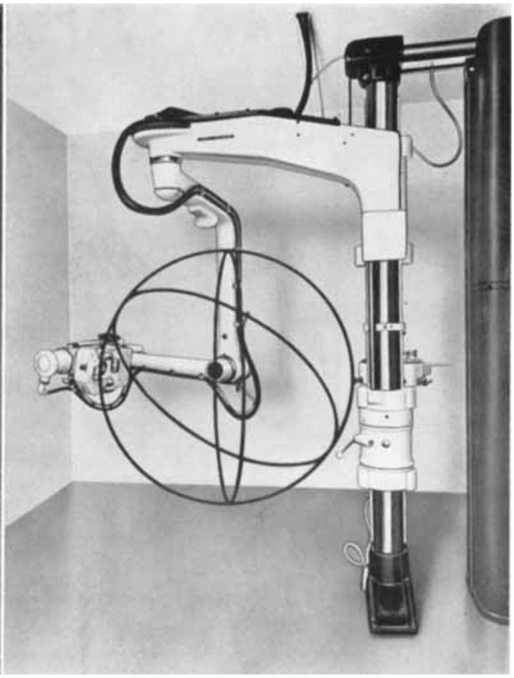

Fig. 2.

Fig. 1. The Mimer installation. 1 — Wall-floor stand, 2 — Cantilever, 3 — Vertical arm, 4 — Tube arm, 5 — Roentgen tube, 6 — Primary diaphragm, 7 — Support arm for object table, 8 — Object table.

Fig. 2. The ranges of rotation of the roentgen tube are indicated by the three circles.

of this sphere can be moved for a distance of 60 cm in a vertical direction. In the Lysholm skull table the focus-film distance is comparatively short, whereas in the imitations this distance has been considerably increased, often on the pretext that in comparison with the original skull table this constituted an advantage. Some lack of appreciation of the importance of drawing full benefit from the divergence of the beam of rays is revealed in this reasoning, however. The various anatomic parts of the skull, since they are at different distances from the film, will at a short focus-film distance appear with different degrees of sharpness; and these distance differences in the skull are of such a magnitude that views produced under such conditions assume a three-dimensional aspect which often makes stereoscopy superfluous. The radiation intensity losses are moreover smaller, which facilitates the use of a fine-focus tube. We have therefore considered it appropriate to retain a relatively short focus-film distance for the new unit.

It also seemed necessary that, in contradistinction to the earlier skull table, the new roentgendiagnostic unit should enable fluoroscopy in differ-

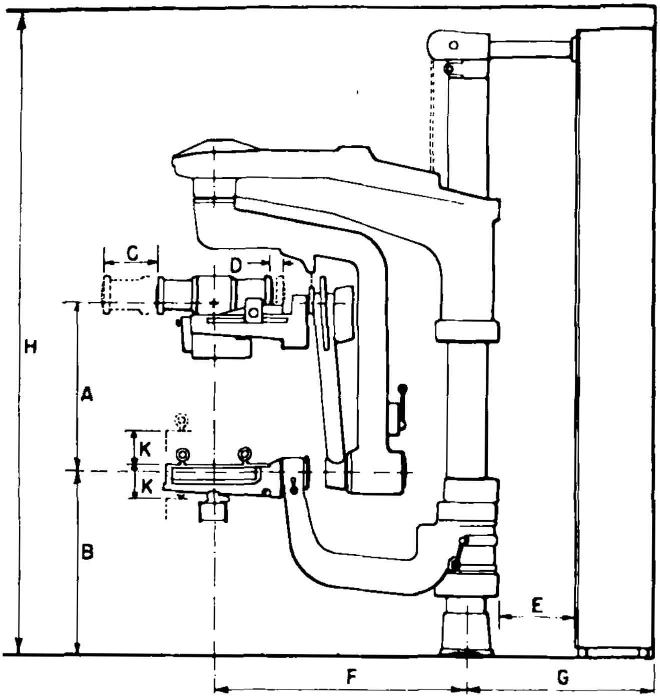

Fig. 3. Schematic drawing of Mimer as seen from the side.

The letters correspond to the following measures in millimeters:
A = 800, B = 1 360—760, C = 250, D = 60, E = 370, F = 1 230, G = 900, H $\geq$ 3 000, K = 100.

ent directions to be performed. Many skeletal examinations are no doubt facilitated if accurate positioning can be achieved with the aid of fluoroscopy, and for the examination of severely injured patients we regard it imperative that this possibility be provided.

Technical description of Mimer

A cantilever is mounted at the upper part of a wall-floor stand, a practically downward-directed, vertically movable arm being suspended at the free end of the cantilever (Fig. 1). An upward-directed pivot arm, which carries the roentgen tube and which we call the tube arm, is mounted at the lower end of the movable arm and articulates with it. These two arms form a V when the roentgen tube is in the zero position. The tube rotates on a horizontal axis, and the vertical arm (suspended from the cantilever) on a vertical axis. The articulating connection between the two arms is at the same level as the plane of the film.

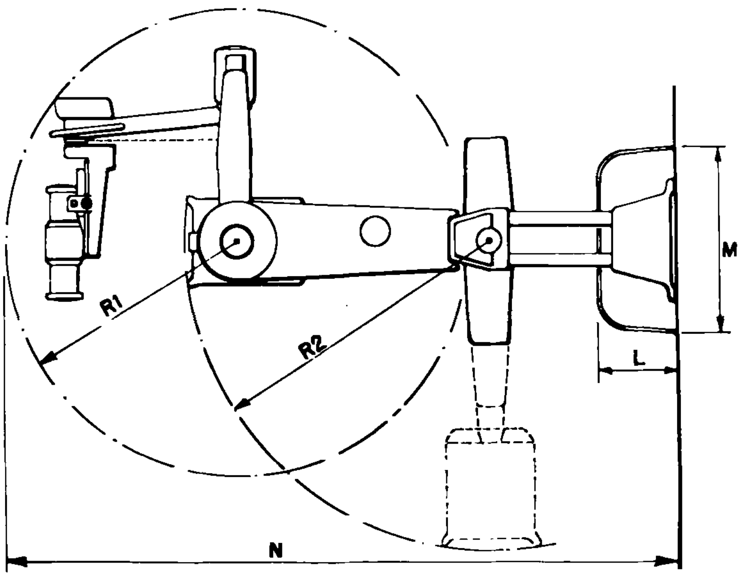

Fig. 4. Schematic drawing of Mimer as seen from above.
The letters correspond to the following measures in millimeters:
L = 370, M = 870, N = 3 240, R1 = 1 110, R2 = 1 480.

Another arm, mounted at the lower part of the wall-floor stand, supports the object table which latter is provided with a secondary grid. This arm can be swung aside to obtain free floor space beneath the roentgen tube, where a film changer unit, a stretcher, or a mobile examination couch may be placed in position, as necessary. A fluoroscopic screen with cassette holder can be attached to the tube arm, and the whole tube-screen assembly turned around the patient so that fluoroscopy and roentgenography can be carried out from any desired direction. A combination of movements of the vertical arm and the tube arm enables the focal spot to be placed anywhere on the spherical surface. The central ray is normally directed towards the centre of a sphere of a radius of 80 cm. Any focus-film distance between 70 and 90 cm may, however, be employed by raising or lowering the object table. The central ray may also be decentralized either by a lateral shift of the roentgen tube or by tilting the carriage on which the tube is mounted. The direction of the central ray is indicated by a light pointer. The centre of the sphere is normally at the same level as the centre of the object table, with a possible maximal movement of 60 cm in a vertical direction. The movement of the tube is operated electrically by means of a multi-velocity control which allows rapid changes of direction and a fine adjustment at the selected level. The position of the roentgen tube is altered by built-in and remote-controlled motors by which means the movements are rendered effortless.

A clear perspex sheet is fitted in the centre of the top of the object table and the same mirror device as in the earlier skull table is used for observation of the object from below during the positioning, a principle of construction which has proved to be fundamentally sound. A secondary grid and a separate tray for cassettes up to a film size of 30 cm square are accommodated beneath the perspex sheet. The tray can be removed together with or without the grid and both can be rotated for oblique projections. Scales indicate the rotation of the grid in relation to the tube.

The outer dimensions of Mimer are given in the legends to the schematic drawings in Figs 3 and 4. The height of the ceiling of the room in which the unit is installed should not be less than 3 metres because if lower the vertical movement is correspondingly reduced. The unit is provided with several counter-weights, and parts of this counter-balancing system are housed in a wall-mounted cabinet which extends about 32 cm from the wall. We have found it convenient to install the control panel at the side of this wall cabinet. This panel, which measures 80 × 58 × 25 cm, contains the regulating devices for changing the focus-film distance, for the lock and emergency brake of the tube arm, and for the tomographic equipment. The latter is at present substituted for the object table during tomography, which can be performed within an arc of 300°. The distances between the parts of the equipment mounted on the wall and the wall-floor stand can of course be varied to allow for local conditions but it is advisable to provide for the free passage of one operator. As Mimer covers a floor space of about 3.25 × 3 metres, the dimensions of the room in which it is to be installed should not be much less than 4 × 5 metres.

SUMMARY

A new roentgendiagnostic unit, called Mimer, is described. It is particularly suitable for neuroradiologic investigations but is also useful for other types of roentgen examinations.

ZUSAMMENFASSUNG

Ein neues röntgendiagnostisches Gerät, genannt »Mimer«, wird beschrieben. Es ist besonders für neuroradiologische Untersuchungen geeignet, aber auch für andere Gebiete der Röntgendiagnostik verwendbar.

RÉSUMÉ

Les auteurs décrivent un nouvel appareil de radiodiagnostic appelé Mimer. Il est particulièrement adapté aux examens neuroradiologiques, mais est aussi utile pour d'autres types d'examens radiologiques.