tory radiation dose distribution in the individual patient. These indices include the total time of exposure to radiation, the strength of the radiation at source, the length and width of the field, and the position in the body on which the rotation of the beam is centred.

Checking the Plan

The next stage is to check this plan by calculating the resulting dose at various points in the patient's body. For fixed field therapy it takes an experienced planner about half an hour to cover a sufficient number of points to give a reasonably satisfactory picture of the dose distribution. In rotation therapy, on the other hand, it takes him about an hour to calculate the dose at only 5 to 10 key points in the body. This obviously does not provide the comprehensive picture ideally required, but in practice there is no time to cover additional points. Even when the dose distribution has been calculated, however, the planner may still find that it is unsatisfactory, so that the plan has to be altered and the calculations repeated.

Altogether then it takes at least twice as long to produce plans for rotation therapy as for fixed field treatment, and even then they are very much less detailed. It was therefore in the planning of this type of therapy that the radiotherapy department at the Queen Elizabeth Hospital in Birmingham decided first to enlist the computer's aid—selecting the hospital's own small computer for this. The computer is an I.B.M. 1440, a machine designed for commercial data processing rather than scientific calculation. It is small and slow, but it was an advantage to try to use this rather than the larger and faster university machine on account of proximity and better turn-round of work. A programme was written which enabled the dose at 361 chosen points in the body to be calculated, with an error of no more than ±1%, for each of the 36 field positions round the patient, and added up to produce the final dose distribution. The magnitude of these calculations is apparent when it is realized that even the computer takes an hour to do them. Moreover, had the perfectly acceptable and ingenious approximations and programming refinements not been introduced, so reducing the calculations required by a total factor of 25, the computer time required would have made its use totally out of the question.

In planning rotation radiotherapy the physicist chooses the most suitable treatment schedule as before. The treatment indices are then punched into computer-readable cards, together with personal identifying details of the patient and data about the site and size of the tumour. The computer uses the card data, together with information about the treatment machine stored on magnetic tape, to calculate the dose distribution resulting from the physicist's specified plan. The accumulated doses for all 36 points are then printed out, and a much more useful contour map of dose distribution is also produced, which shows the percentage dose curves in relation to body and tumour outlines.

If the hospital acquires a faster computer this should be able to produce dose distributions for several alternative plans for an individual patient, so that the planner can choose the best one. Eventually it should be possible to get the computer itself to choose the best plan—though this will depend on its being given the criteria for the choice, and these have yet to be defined completely. Ultimately it should be possible to programme the computer to plan treatments from scratch, starting with just the details of the patient and of the machine to be used.

NEW APPLIANCES

Improved Sling for the Thomas Splint

Mr. H. McKim Thomas, lecturer, University Department of Orthopaedic Surgery, Manchester Royal Infirmary, writes: For the correct maintenance of fracture position and patient comfort it is usual for the conventional domett or canvas slings of a Thomas splint to be adjusted and repinned daily. This task is time-consuming and may disturb the position of the fracture fragments. Moreover, it does not usually control the downward slipping of the proximal sling and this exposes a triangular area of unsupported thigh that not infrequently may bulge through the gap, giving rise to considerable discomfort, oedema, and even pressure sores against the ring of the splint.

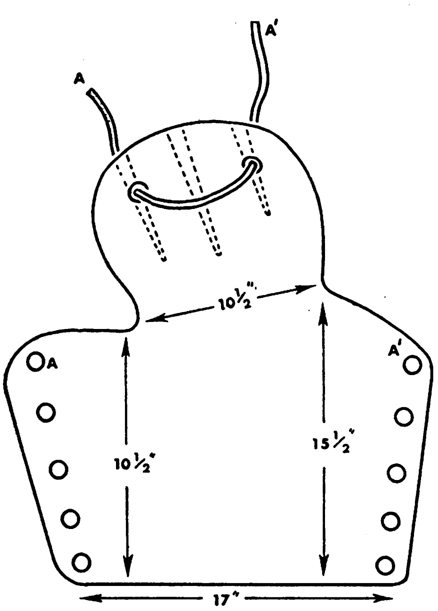

Fig. 1.—Outline pattern and dimensions of the supporting sling.

Previously used alternative slings have various disadvantages: *plaster-of-Paris* is hard and may cause pressure sores; *elasticated stockinet* is not firm enough to support the position of a recent fracture accurately; *leather* is costly to fabricate and difficult to clean adequately.

The sling described shows considerable advantages in all the foregoing respects and has given complete satisfaction and patient comfort in this orthopaedic unit. It requires the minimum of maintenance after application.

The appliance is made from Coutille as used in corset manufacture. This is cross-stitched to provide rigidity, and brass eyelets are fitted at the margin for the single lace required (Fig. 1). Its shape adapts itself easily to all the usual adult sizes of Thomas splint and is reversible to suit the right or left side. Three "darts" in the material are necessary to provide sufficient looseness for a smooth fold over the ring of the splint.

Even with the patient already on a splint the "tongue" is easily introduced through the ring with the same lace that will hold it and the side extensions in place. Diagonal lacing (Fig. 2) permits easy adjustment of the sling tension, which does not usually require further attention throughout the full period of conservative management. The lacing does not cause uncomfortable ridges and there is a smooth surface extending from the thigh to the buttock fold.

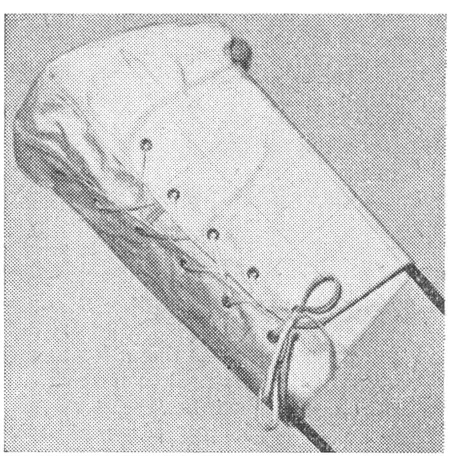

Fig. 2.—Rear view to show the method of lacing.

The sling is not soiled in use by male or female patients and is easily laundered without detriment.

I am indebted to Messrs. Prince & Fletcher, Manchester, who produced the prototypes for me, and also to the department of medical illustration of the Manchester Royal Infirmary for the photograph and the diagram.