A New Method for the Manufacture of Splints for the Lower Limb*

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Before starting the description of this new method and the operation of the pertinent equipments, it is advisable to remind that whilst in the manufacture of prostheses for lower and upper limbs the orthopaedic technique has distinguished itself, during these last ten years, in the admirable applied research of new methods and techniques, in comparison little has been made for the splints and, among them, for the ones pertinent to the lower limb.

The practical technique, still used by almost the totality of the manufacturers, is therefore still such that the various manufacturing steps of them have to be considered as not very simple and, in any case, long.

The disabled has to undergo first to a visit by the orthopaedic physician who, in agreement with the technician fixes in a general line the manufacturing and functional specifications of the splint.

The patient then goes to the Orthopaedic Workshop where the measurements and the graphs that are necessary for the first rough preparation of the splint in trial step are taken on him. The systems used to this date for all this are, to tell the truth, to be considered almost empirical and the graphs in a special way, have to be considered of doubtful congruence, also because they are made when the patient is lying in a horizontal surface. In this way it is not easy to notice every necessary specification or measurement, peculiar to the limb in standing position. After this operation the patient leaves therefore the Orthopaedic Workshop and in the technical department the manufacture of the splint takes place, in its trial step, with the frames already connected to one another either by welding or riveting, and with the binding system (belts or pressing devices) of the temporary type.

When this operation has been

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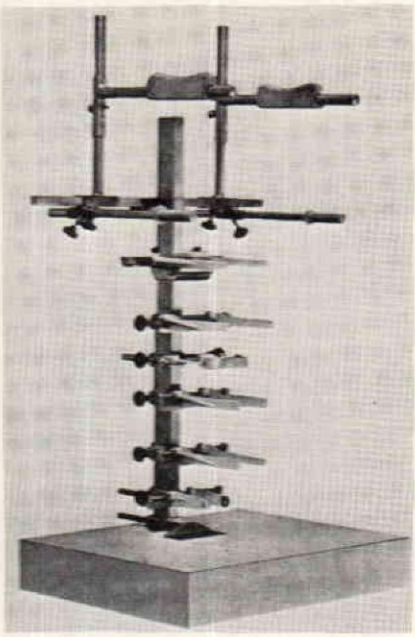

Figure 1

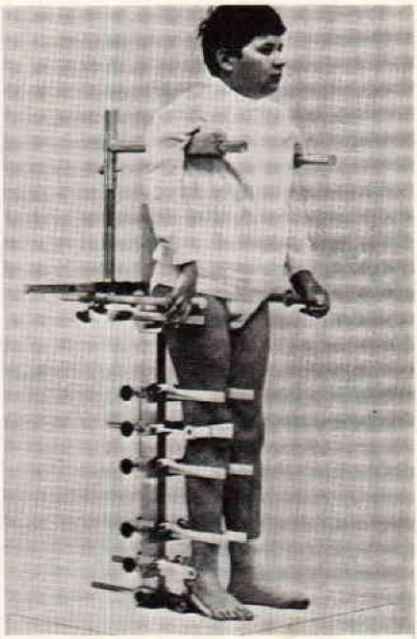

Figure 3

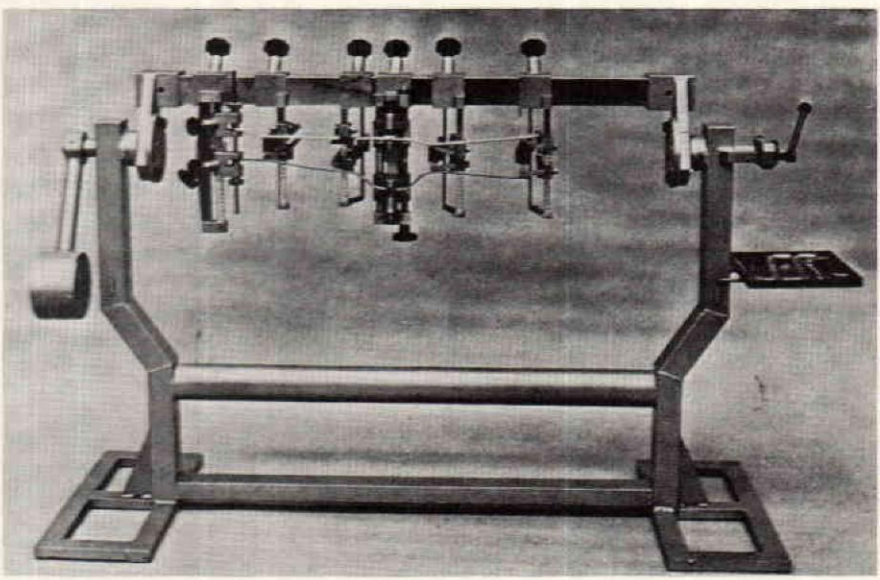

Figure 2

completed, the patient is called again, and the so called trial is made. In this new step, which is the most toilsome and delicate, most of times it is necessary to perform long changement and fittings, which require a remarkable loss of time both for the technician and for the patient.

When people are certain of the static and dynamic congruity of the splint, it is then possible to take care of the finishing operation, and then of the delivery to the disabled.

Of course this method, further to the technical criticisms, also favours very important considerations of economical character. The cost of labour, including the changements and the trial times, is very high and the industrial cost of the finished device is very high with reference to the value of the material and of the components that have been used.

The new method that we have studied and that we now introduce, allows further to a more rational obtaining of the measurements and the manufacture of the splints exactly answering to the actual configuration of the patient, also a remarkable saving of time in the manufacture, with a noticeable influence in the cost and therefore on the sale price.

Further the patient, who sometimes lives in places far from the technical department, is not any more troubled by calls for the trial, with a great saving of time and of travel expenses.

The method allows to obtain more rationally the measurements and the manufacture of the splints

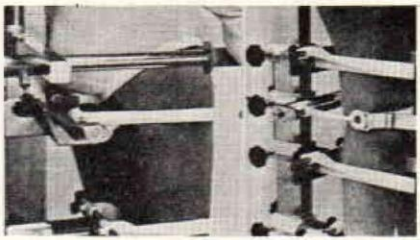

Figure 4 Figure 5

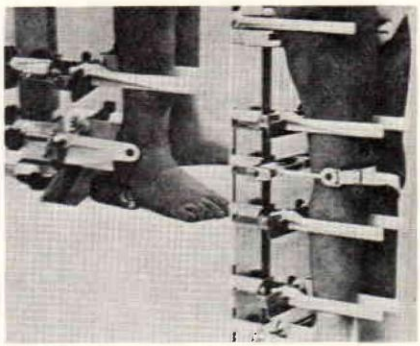

Figure 6 Figure 7

exactly answering to the detected data.

Our unit is composed by two equipments:

1) A measuring bearing device (fig. 1).
2) A revolving bench for the manufacture (fig. 2).

On the *measuring bearing device* the patient is put in his standing position, with the disabled limb resting on the ischium in a suitable bracket, adjustable in height (fig. 3). Two adjustable armpit rests, and two handles to be gripped by the hands, bear the patient who can thus put himself at his ease, with his feet resting on the base surface and with the disabled limb in the position prescribed by the orthopaedic physician.

On a pillar, graduated in millimetres, are fitted the detecting units which permit to determine:

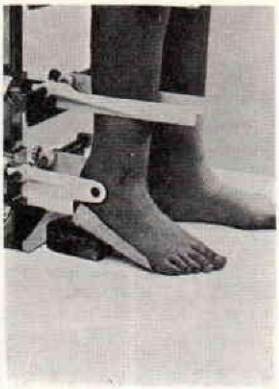

Figure 8

A) the height of the ischiatic rest (fig. 4);

B) the position of the articulation centre of the knee defined in the three orthogonal planes (fig. 5);

C) the position of the articulation centre of the malleolus with reference to the articulation centre of the knee (fig. 6);

D) the width of the splint: above and below the knee, at the thigh and over the malleolus (in correspondence of the connection positions of the cross half rings of the splint frame) as well as the position of said points with reference to the knee articulation (fig. 7);

E) the position of the rest sandal for the foot with reference to the splint (fig. 8).

In this way are determined, according to the known criteria of the orthopaedic technique, all the important anatonical positions for the articulation and for the holding.

For each of said positions, the bearing measuring device gives us two values, each expressed with a number read on a suitable graduated scale, which determine the position in height and in width.

The adjustable touching devices, that are used to detect the sizes of the splint at the height of the four cross half rings, are rested against the limb, in correspondence of the anatomical holding positions (fig.

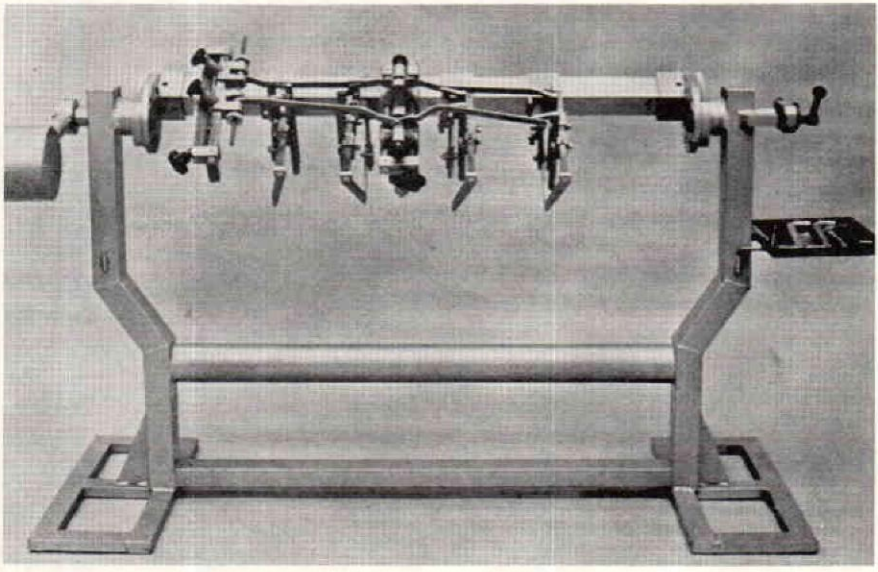

Figure 9

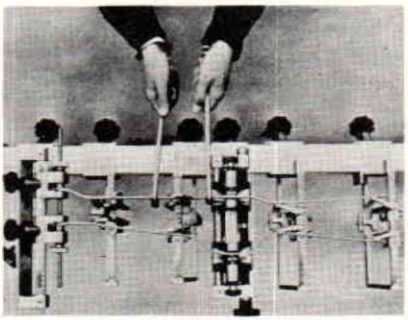

Figure 10

7), so that the limb itself is in the same conditions in which it will be when wearing the splint.

Operating on the touching devices, and pressing them more or less against the holding positions, it is possible to determine, always during the measurement step, the possibilities of lateral correction that can be obtained with the splint on the limb, and that the orthopaedic physician has prescribed.

The measurements obtained in the above described way, are brought on a special measurement form, which is used for the presetting of the *bench for the manufacture* of the splint.

Said bench has bearings with adjustable rest pointers, and with devices suitable to allow the perfect alignment, during the manufacture, of the articulations of the knee and of the malleolus.

By means of suitable graduated scales, it is possible to put the articulation centres and the rest pointers, in the pertinent positions perfectly equal to the ones that the detecting touching devices had in the measuring bearing device (fig. 9).

The rods, of steel profile or of other metal, with which the splint has to be manufactured (fig. 10), are then cut and shaped in such a way to follow the rest pointers, and to have the articulation axes correspond, using for this operation the bench as a jig for the shaping of the rods and for the pre-setting of the already manufactured articulation. Then the operations of preparation and welding of the various components (rods, cross half rings, articulations, possible articulated sandal, etc.) are made.

On this polyvalent jig, the splint is thus manufactured in a perfectly congrous way and, with the exception of rare very difficult cases, the technician can proceed with the finishing operations, without any necessity of trials on the patient.

The described equipment has been in operation in our Workshops for almost one year, and the results obtained on numerous patients have been actually satisfactory, both from the economical point of view, and from the quality point of view.

We therefore point it out especially to the largest Orthopaedic Workshops and Centres, that we know are pressed by the problem to shorten the hospital staying for the patients who only require the supply of orthopaedic equipments.

We realize that the whole of the equipment can appear a little complicated at its first sight, to the artisan technicians, but we can assure that its use is simple and however is such to compel correctly the operator to a rational and technically exact method and manufacturing sequence.