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Additions to the Vertical Fabrication Machine

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The Vertical Fabrication Machine (Fig. 1) is a device intended to facilitate the bench alignment and transfer of below-knee and above-knee prostheses. As such the clamps and locking fixtures are designed to permit a component to be moved readily and returned to the same position or shifted to a new position accurately. With the intention of accurately maintaining alignment, the central vertical column and horizontal arms are keyed with longitudinal slots to which toggles of the clamps mate. The use of these features is absolutely essential to ensure precise duplication of alignment in the transfer process, but in the bench alignment process the lack of flexibility in positioning components is a hindrance. In order to overcome this problem and to extend the function of the vertical fabrication machine, the following subsidiary components have been developed.

Universal Positioning Arm

The Universal positioning arm (Fig. 2) when substituted for the top arm (Fig. 3) of the Vertical Fabrication Machine enables a pipe or rod clamped in it (Fig. 4) to be rotated in three planes and moved linearly in two. Linear motion in the third plane is accomplished by using the other features of the Vertical Fabrication Machine enables a pipe or rod clamped in it (Fig.4) to be rotated in three planes and moved linearly in two. Linear motion in the third plane is accomplished by using the other features of the Vertical Fabrication Machine. The Universal Positioning Arm was originally devised for the setup of upper-limb prostheses, and in use it is intended that the wrist unit or elbow turntable be mounted on the bottom arm (normally used to hold the ankle block) or affixed to the table top by a bead of clay. The Universal Positioning

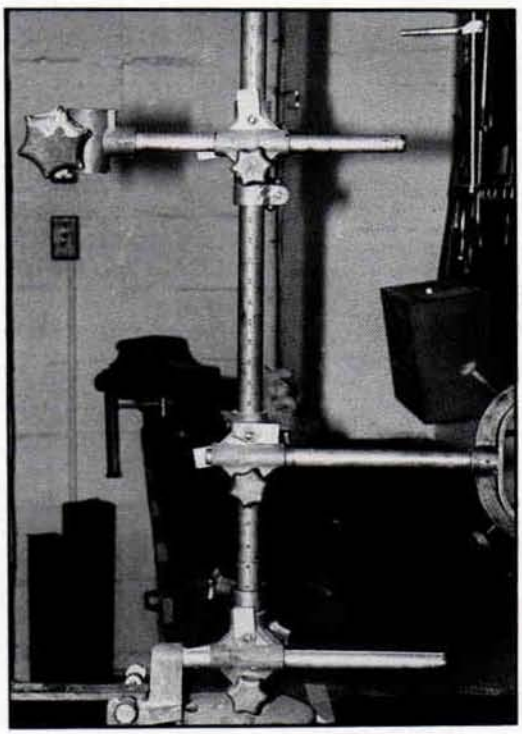

Fig. 1. Vertical Fabrication Machine.

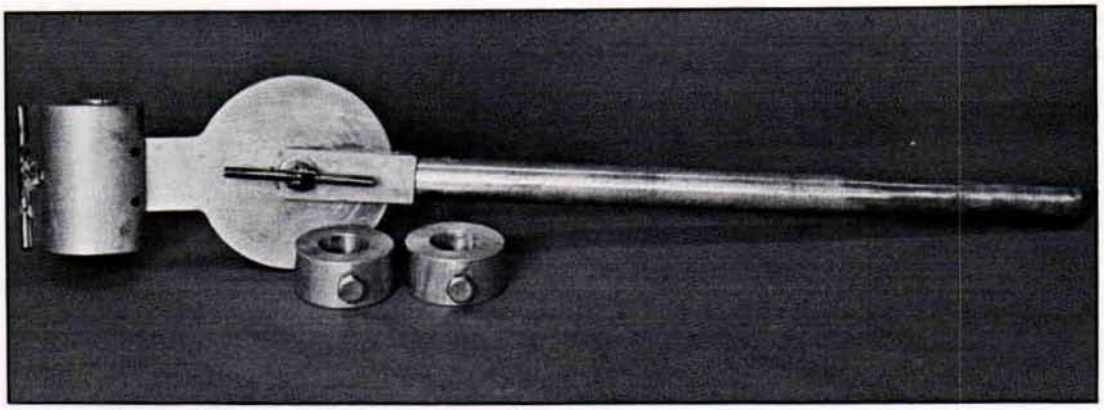

Fig. 2. Universal Positioning Arm. Two locking rings are shown in the foreground.

Arm is then used to position the socket relative to the wrist unit or elbow turntable, a plastic or paper cone is taped in place between them and wax or urethane foam poured to complete the set-up. The device has also been used to facilitate the bench alignment of lower-limb prostheses (Fig. 4) and the modification of plaster-of-Paris models with forefoot buildups for partial foot prostheses. In this context it can be used in conjunction with either the flat table top or with a casting board to duplicate the contour of a shoe. In either instance, the surfaces should be covered with plastic wrap to act as a separator. If desired flat slabs of modeling clay can be used to create a form into which plaster of Paris can be poured.

Hans Richard Lehneis has described a similar device (2) for use in bench alignment of below-knee prostheses with PVC pylons. While undoubtedly simpler to construct, in this author's opinion it suffers from the disadvantage that one adjustment can not be made independent of another.

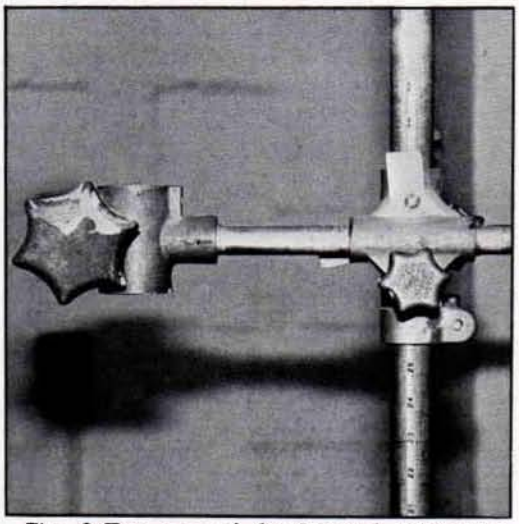

Fig. 3 Top arm of the Vertical Fabrication Machine.

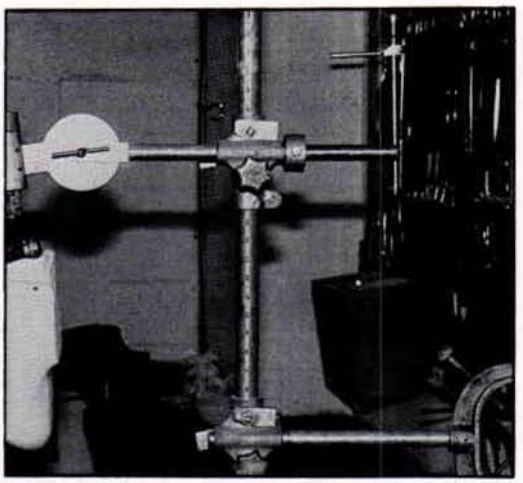

Fig. 4 Universal Positioning Arm installed in the Vertical Fabrication Machine with a below-knee socket model held in place as for establishment of bench alignment and distal buildup prior to vacuum forming. The two locking rings insure that changes in rotation will not lead to inadvertent linear changes.

Knee Joint Alignment Jig

A U.S.M.C. alignment jig (2T402) (Fig. 5) intended for use in fracture bracing has been modified to accept the various adapters of the Otto Bock alignment jig (743R4) (Fig. 6) and, in addition, other adapters have been made to accommodate the English thread sizes of American knee joints. To complete the process, modifications have been made to both the alignment jig and the Vertical Fabrication Machine to permit the alignment jig to be used instead of the regular knee bolt clamp (Fig. 7). This was done originally so that the Vertical Fabrication Machine could be used to apply the buildups (Fig. 8) necessary for the fabrication of the V.A.P.C. Genucentric Knee Orthosis (1). A special pair of discs with central pointers (Fig. 9) were fabricated to fit the alignment jig for this purpose and the Universal Positioning Arm is used to align the plaster model. It is, of course, possible to use these various modifications to position a knee orthosis or a knee-ankle-foot orthosis model and contour and align the uprights of conventional knee joints. Although cumbersome and awkward, it has the advantage of enabling the orthotist to duplicate the functional position of the

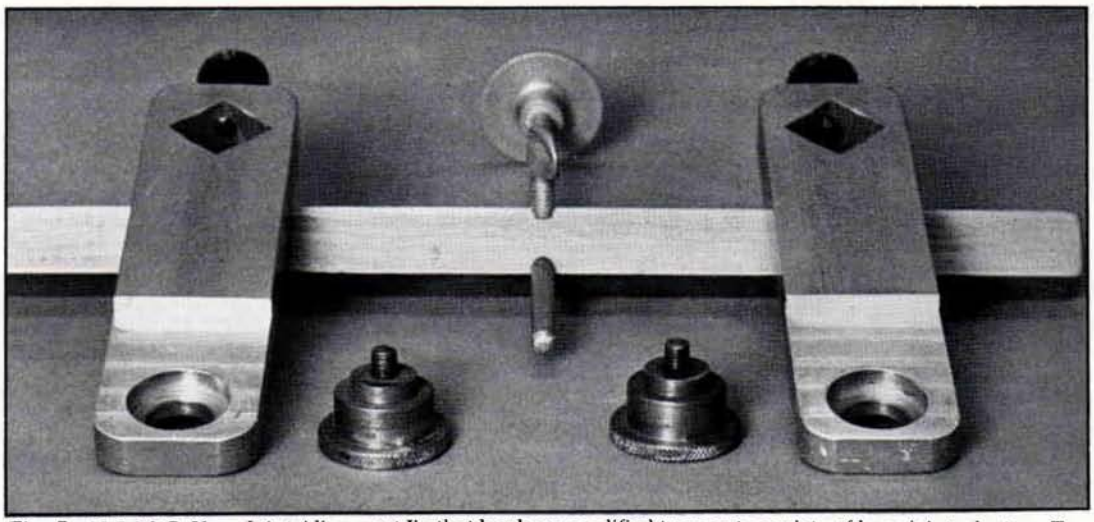

Fig. 5. U.S.M.C. Knee Joint Alignment Jig that has been modified to accept a variety of knee joint adapters. Two of these are seen in the foreground.

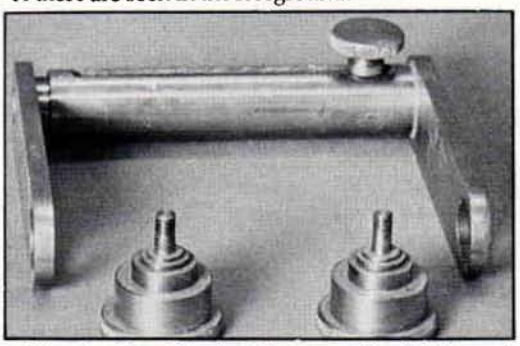

Fig. 6. Otto Block Alignment Jig 743R4 and two of the adapters that accompany it. These adapters are fully compatible with the modified alignment jig shown in Figure 5.

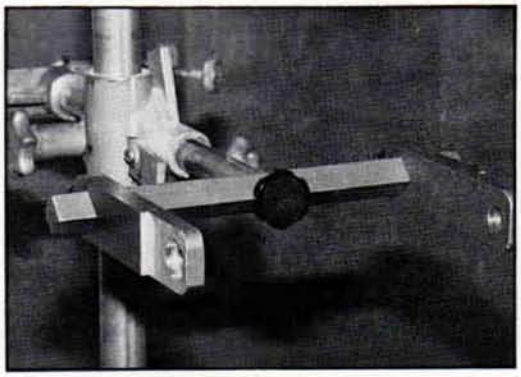

Fig. 7. Modified alignment jig mounted in the Vertical Fabrication Machine.

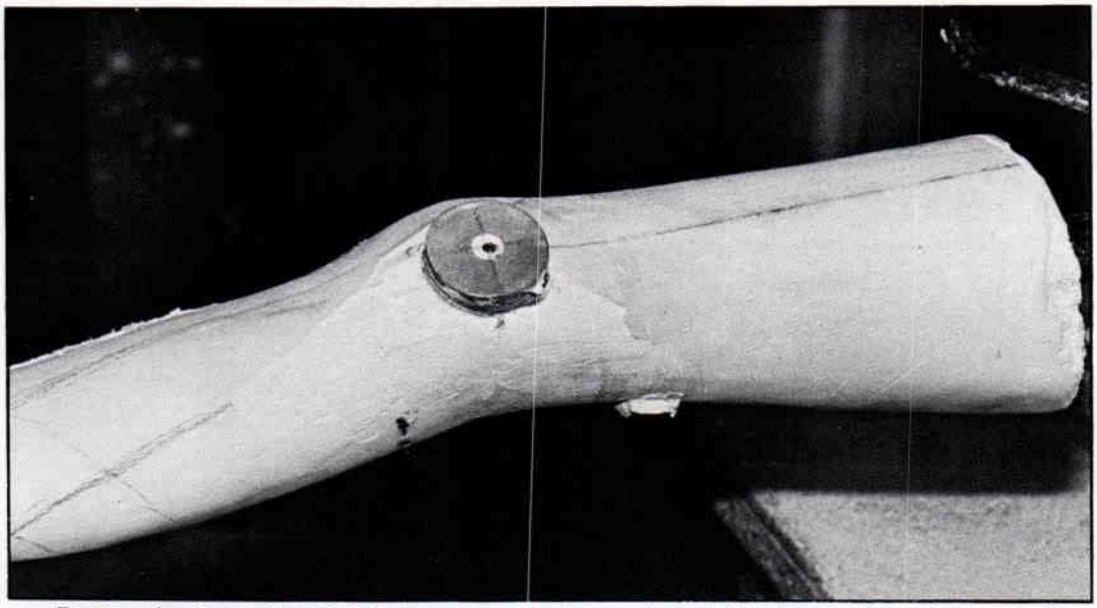

Fig. 8. Aluminum disc that has been mounted on a plaster of Paris model as one step in the fabrication of a VAPC Genucentric Knee Orthosis. In use, plaster is removed from the underlying area so as to maintain the proper medial-lateral diameter, and alignment is established in the Vertical Fabrication Machine. Polyester resin is then used to secure the disc in place, the mounting fixture is removed, and plaster of Paris is used to create the proper contours about the disc. After fabrication of the orthosis the disc can be recovered for further use.

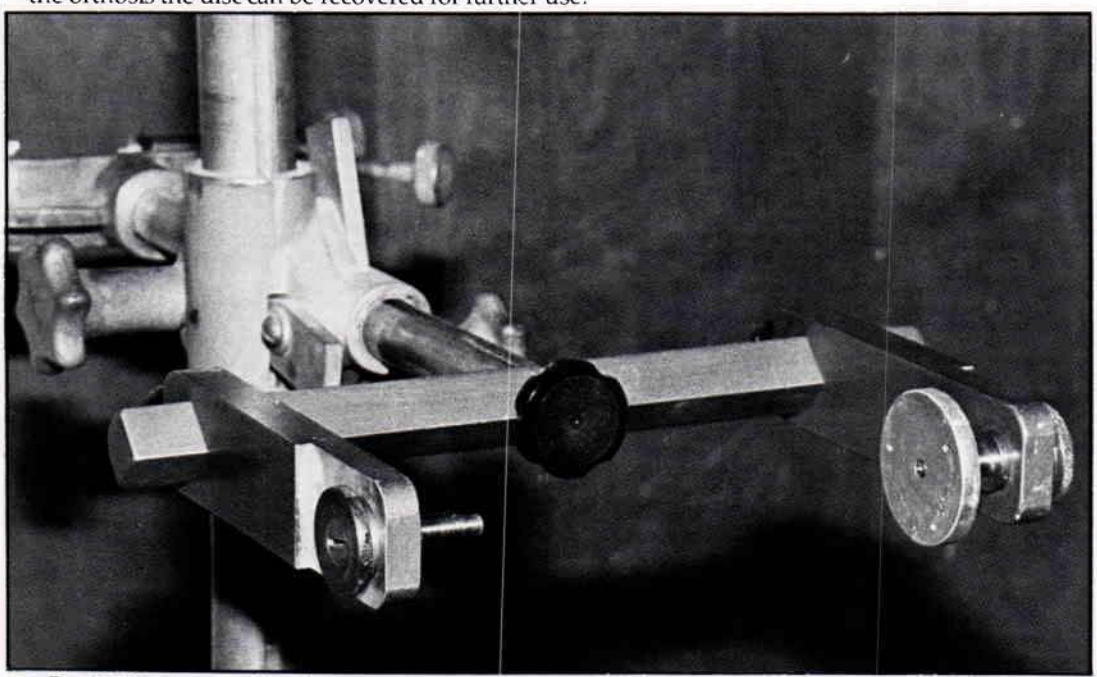

Fig. 9. Brass mounting fixtures mounted in the alignment jig with the appropriate adapters. These mounting fixtures are turned down to points on the ends towards the model. A threaded aluminum disc, as described in Figure 8, is mounted on the right-hand mounting fixture. The point of the fixture is discernible in the center of the disc.

limb, and thus accurately visualize the alignment of components. In a similar fashion with appropriately modified alignment jigs, it would be possible to align other orthotic joints on models and, in addition, the knee joints of a below-knee prosthesis that required joints and corset. In this latter instance, it would be desirable when at all possible to first perform dynamic alignment so that once applied the joints would be horizontal.

Summary

The use of a Universal Positioning Arm and Knee Joint Alignment fixture to extend the versatility of the Vertical Fabrication Machine in prosthetics and orthotics has been described. This includes situations with which the author has had personal experience as well as some purely hypothetical ones.

Literature Cited

1. Foster, Robert and John Milani, "The Genucentric Knee Orthosis – A New Concept." *Orthotics and Prosthetics, Vol. 33, No. 2, pp. 31-44, June 1979.*
2. *Lehneis, Hans Richard, "A Thermoplastic Structural and Alignment System for Below-Knee Prostheses." Orthotics and Prosthetics,* Vol. 28, No. 4, pp. 23-29, December 1974.

Reference

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