

ABSTRACT OF SUMMARY REPORT ON RESEARCH AND DEVELOPMENT IN THE FIELD OF ARTIFICIAL LIMBS^a

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At the end of the contract year, close to 2000 *Swing and Stance Control Systems* had been distributed by the Veterans Administration and ourselves. This proves the need for this type of above-knee control system as well as the acceptance of our design. Nevertheless, an intensive effort has been made throughout the contract year toward improving the function and extending the maintenance-free life of the S-N-S system. This effort led to a total of 18 design changes which resulted in:

1. the elimination of three noises,
2. the reduction of wear in three places,
3. the prevention of two potential external and three potential internal leaks,
4. the facilitation of the swing-control adjustment,
5. the elimination of inadvertent changes of the swing-control adjustment,
6. a sturdier bearing attachment inside the shank, and
7. the exchangeability by the prosthetist of the bearing at the top of the piston rod.

These changes have been applied to all production and repair systems at the earliest possible instance.

The transition to the shortened version of the S-N-S system (named "Standard Length" S-N-S), mentioned in last year's Summary Report, has been completed without serious difficulties. The first production run started in April 1972 as planned. This changeover also includes a modified wooden setup which accommodates the shortened system.

From our own experiences with commercial customers and from the experiences of the Veterans Administration with veteran amputees, it became clear that some prosthetists and therapists do not fully understand the potential uses and benefits of the S-N-S system in spite of the

^a Based on work performed under VA Contract V101(134)P-67. For a copy of the complete report, write to: Editor, Bulletin of Prosthetics Research, Research and Development Division, Prosthetic and Sensory Aids Service, VA, 252 Seventh Avenue, New York, N.Y. 10001.

information contained in our manual and in the training instructions issued by the VA. It was therefore decided to update an existing movie showing the S-N-S system in various activities, and to make this movie available to VA Hospitals and to other interested parties through VA channels. It is hoped that this will prove beneficial for the understanding of the functions of the S-N-S system and for the training efforts of the prosthetists and therapists involved.

Shake-down testing of the *Hydraulic Ankle Control Unit* by VAPC in New York has been underway since October 1971. Soon after the beginning of the shake-down testing, it became clear that the reactions of a very experienced New York test amputee (Mr. H. Kramer) toward the Ankle Control System differed markedly from the reactions of our own test amputee. After many tentative design modifications and subsequent test runs in New York and in Dayton, it was established that the following design changes appeared highly desirable:

1. The bypass around the vane-type piston, which opens on removal of the load from the prosthetic foot to enable the foot to return from a possible plantar-flexed position, will be modified. The modification eliminates the 5 deg. forward motion of the shank, formerly needed to complete closing the bypass at the beginning of the stance phase, because it interfered with the alignment stability in standing.
2. The transverse rotation feature will be eliminated because of its questionable usefulness and its undesirable side effects.
3. The eversion/inversion feature will be modified in such a way that the inversion motion will be retained but the eversion motion will be eliminated because it reduced lateral stability.

These modifications were also accepted by our own test amputee and by a third test amputee later recruited in the New York area. The necessary redesign is more basic in nature than one would ordinarily expect as a result of shake-down testing, but the effort will be worthwhile because the resulting unit will be simpler, quieter, more reliable, and less expensive than the existing three prototypes.

The manufacture of the parts for the prototype of the *Voluntarily Actuated Swing and Stance Control Unit* began in September 1971 and was finally completed in February 1972 after some delay due to other high-priority work.

In the meantime, it was established that the application of the design principles used in shortening the S-N-S system (see Point 1 above) to this unit will allow sufficient space for the installation of Belleville springs for providing the "double knee bend" (see last year's Summary Report) without exceeding the standard dimension of $7\frac{1}{2}$ in. between the knee axis and the shank axis provided for in the VAPC Multiplex setup.