

# Educational Programs on Fluid-controlled Mechanisms for Above Knee Prostheses

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For a number of years research and development activities have been conducted on fluid-controlled mechanisms in above-knee prostheses. Early efforts in the Artificial Limb Program were directed at fluid control of knee mechanisms during stance phase of amputee gait in order to minimize knee buckling. About 1950 the emphasis shifted to fluid control of the swing phase of walking, with reliance placed upon the more skillful and bio-mechanically-sound methods which had evolved in the fitting and alignment of above-knee prostheses to achieve stability during the stance phase.

Two forms of swing-control mechanisms have already become commercially available, namely the Hydra-Cadence and the DuPaCo hydraulic units, the latter on a more limited scale. It is anticipated that the Henschke-Mauch "HYDRAULIK" System, Model "B", will be produced in substantial numbers within the next few months for use with a planned VA Clinical Application Study. A fourth swing-phase device, the UC-B Pneumatic unit, is still experimental but is expected to become available at a somewhat later time. Work continues on fluid control for the stance phase, with one device, the Henschke-Mauch Model "A" swing-and-stance unit, in an advanced stage of evaluation. Thus it is timely to review some of the educational efforts which have been devoted to fluid-controlled mechanisms as well as to outline some future plans and goals.

In 1959 the Prosthetic and Sensory Aids Service of the Veterans Administration, led by its Director, Dr. Robert E. Stewart, recognized that informational and educational programs were needed to acquaint clinical personnel with the newly-emerging hydraulic mechanisms. In October of that year a Clinical Application Study of the Hydra-Cadence prosthesis was announced. Primarily intended to gain broad clinical experience with this new device under a wide variety of conditions, the study has also served as an educational medium for the 27 participating VA Orthopedic and Prosthetic Appliance Clinic Teams, including 76 commercial prosthetists from 67 limb facilities.

In November 1959, the Prosthetics Education Program of the University of California at Los Angeles introduced the teaching of the Hydra-Cadence prosthesis in its Above-Knee Prosthetics Courses for prosthetists, physicians, and therapists. Subsequently, the Hydra-Cadence prosthesis was taught at UCLA in one-week Advanced Above-Knee Prosthetics Courses, held prior to or after regular courses on below-knee techniques. During the period November 1959-March 1961, ten courses including the Hydra-Cadence unit were conducted by UCLA. Approximately 100 prosthetists participated in such specialized training. Of this group, some 80 were from commercial limb facilities.

Recognizing that its programs would require greater numbers of prosthetists trained in hydraulic and pneumatic principles and in all the fluid-controlled devices likely to become available in the next few years, the Veterans Administration initiated plans in the spring of 1961 for assuring such coverage. In cooperation with the American Orthotics and Prosthetics Association and with the assistance of instructional personnel from the three prosthetics schools, the Veterans Administration conducted a tuition-free seminar on fluid-controlled mechanisms at the Eden Roc Hotel in Miami Beach, October 26-28, 1961, immediately after the AOPA National Assembly.

Registration for the seminar was limited to prosthetists who had satisfactorily completed a university course in above-knee prosthetics at New York University, Northwestern University, or UCLA. (Completion of a "suction socket course," of the type offered a number of years ago by the Veterans Administration, the then OALMA, and the National Research Council, was *not* considered as qualifying for participation in the seminar.) A total of 87 prosthetists who had completed the prerequisite above-knee course enrolled in the seminar.

Because of their immediate or anticipated availability, coverage was limited to the following four swing-control devices: the Hydra-Cadence, the Henschke-Mauch "HYDRAULIK" Model "B", and the DuPaCo hydraulic units, and the UC-B pneumatic unit. Supplementing instruction on these devices were lectures on basic principles of fluid control and the significance of fluid control in lower extremity prosthetics. An examination was given at the end of the three-day session, with 78 of the 87 participants attaining passing grades. (Appendix A contains a list of the 78 prosthetists who successfully completed the seminar, with their respective limb facilities or organizations.) We are grateful to the American Orthotics and Prosthetics Association and to the three prosthetics schools for their assistance with this seminar which was acknowledged by all concerned as highly successful.

Two more such seminars for qualified prosthetists have been announced by the Veterans Administration, one to be held in New York, February 19-21, 1962 and the other in Salt Lake City, May 31-June 2, 1962.

In a further effort to train more prosthetists in broader perspectives of swing-control mechanisms, UCLA conducted a seminar on January 26, 1962 for graduates of their ten courses where the Hydra-Cadence unit already had been intensively covered. Another seminar will be held by UCLA on March 23, 1962, during a regular above-knee course, and again limited to prosthetists who had previously successfully completed a UCLA course involving the Hydra-Cadence device. Provision has been made for evening sessions to assure adequate coverage of all devices.

Northwestern University will offer intensive instruction in the four swing-control devices as part of the Above-Knee Prosthetics Course to be held March 19, 1962 through April 6, 1962. New York University decided not to offer such coverage in the courses scheduled through this academic year, beyond brief indoctrination typical of numerous other mechanisms.

It is believed that by June 1962 the objectives set by Dr. Stewart and his staff will have been met. There will be an adequate number of prosthetists throughout the country trained in the fitting of fluid-controlled devices to assure such prosthetics service, when indicated, not only for disabled veterans but for the much larger numbers of other amputees as well.

Effective January 2, 1962, the Veterans Administration authorized the issuance, to eligible veterans, upon appropriate prescription, of above-knee



prostheses incorporating the Hydra-Cadence mechanism. Contractual conditions require that the Hydra-Cadence prosthesis "must be constructed by or under the close supervision of a prosthetist who has satisfactorily completed either:

- a. A university course on Above-Knee Prosthetics\* which included specific instruction on Hydra-Cadence mechanisms.
- b. A seminar on Fluid-Control Mechanisms conducted by the Veterans Administration.
- c. Participation in the VA Clinical Application Study of the Hydra-Cadence Above-Knee Artificial Leg during which he fitted or supervised the fitting of one or more Hydra-Cadence Limbs which were accepted as satisfactory."

As the other three fluid-controlled devices become acceptable for routine issuance, similar contractual requirements are planned. The Veterans Administration has compiled lists of prosthetists who have met such requirements for the Hydra-Cadence prosthesis—by virtue of one or more of the three methods cited above—as well as those who are qualified to furnish *all four* devices discussed in this article. (See Appendix B for a summary of the VA-approved methods of attaining qualification.) We anticipate that UCLA and Northwestern University will include fluid-controlled devices as an integral and substantial part of their regular above-knee prosthetics courses, and we would hope that New York University would develop similar plans for the next academic year. Since the Veterans Administration does not plan to conduct any additional seminars for prosthetists after June 1962, we would hope that the universities would provide at least equivalent opportunities for prosthetists who have already had basic above-knee prosthetics courses to acquire qualifying training in fluid-controlled devices.

Though we have been primarily directing our attention to educational programs for prosthetists, we have not lost sight of the need for orienting the other disciplines concerned with the prosthetics care of the amputee. As has been stated, UCLA has been including sessions on the Hydra-Cadence mechanism in courses for physicians and therapists and will expand such instruction to include the other devices. Northwestern University will offer some instruction in fluid-controlled devices in lower-extremity courses for physicians and therapists. As in the past, New York University will offer limited coverage of such devices in the courses scheduled through June 1962, and will explore the possibility of more detailed instruction during the next academic year.

On January 30, 1962, an instructional course on hydraulic knee mechanisms was presented by Northwestern University at the meeting of the American Academy of Surgeons in Chicago. Thirty surgeons attended this session.

The Prosthetic and Sensory Aids Service has been invited to conduct a three-hour session on fluid control in prosthetics at the meeting of the American Congress of Physical Medicine and Rehabilitation to be held in New York in August 1962. A similar invitation is anticipated from the Association of Medical Rehabilitation Directors and Coordinators for their July 1962 meeting in Buffalo. In addition, the Prosthetic and Sensory Aids Service may also conduct two or possibly three seminars for selected VA physicians and therapists during the next several months.

In addition to courses and seminars, other media have been used to disseminate information about hydraulic and pneumatic mechanisms for

\*Some courses at UCLA were called Below-Knee Prosthetics, one week being devoted to Advanced Above-Knee Prosthetics.

above-knee prostheses. As part of its "Project Slides," the Prosthetic and Sensory Aids Service prepared a number of slides and descriptive captions dealing with fluid-controlled devices for distribution to the field. The Committee on Prosthetics Education and Information of the National Academy of Sciences-National Research Council arranged for the procurement of 100 sets of such slides for distribution to medical schools, rehabilitation centers, and other interested organizations. The second volume of the Orthopaedic Appliances Atlas, published in 1960, described hydraulic mechanisms with schematic drawings and photos as well as text. Reports on the Henschke-Mauch Model "B" by New York University and by the Committee on Prosthetics Research and Development, NAS-NRC, have received wide circulation.

Future plans for the dissemination of information include an exhibit on fluid-controlled mechanisms. Publication of a report on our Clinical Application Study of the Hydra-Cadence prosthesis should provide valuable insights with respect to this device and possible implications for other hydraulic devices. The NAS-NRC is planning a future issue of the journal, *Artificial Limbs*, devoted to hydraulic mechanisms in lower extremity prosthetics. An Ad Hoc Committee on Fluid-Controlled Legs of the Committee on Prosthetics Research and Development has been developing a composite technical report on all fluid-controlled swing-phase or stance-phase devices in production or under development. This report will be a most helpful contribution to the understanding of fluid-controlled devices.

After a long history of development, fluid-controlled mechanisms have become a part of the "legamentarium" available to prosthetics practice. It is the responsibility of all interested organizations to assure that sufficient knowledge is available for proper prescription, fabrication, alignment, training, and checkout so that appropriately selected amputees may realize the maximum offered by the properly fitted device. Though a good start has been made, we think much remains to be done.

## APPENDIX A

### LIST OF PEOPLE WHO SUCCESSFULLY COMPLETED MIAMI BEACH SEMINAR ON

### FLUID-CONTROLLED MECHANISMS

October 26-28, 1961

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|--|--|
| ANAIR, Wilfred J., Starkey Artificial Limb Co., Inc., Hartford, Conn.      | CALDWELL, Jack L., J. E. Hanger Inc., Tampa, Florida.                                    |
| BARGHAUSEN, Karl J., J. E. Hanger Co., Pittsburgh, Pa.                     | CLEMENS, Wesley G., J. E. Hanger Co., Columbus, Ohio.                                    |
| BERRYMAN, George W., J. E. Hanger Inc., Orlando, Florida.                  | DANIEL, Roland H., The Winkley Art. Limb Co., Buffalo, New York.                         |
| BIDWELL, Thomas R., House of Bidwell, Inc., Madison, Wisconsin.            | DANKMEYER, Charles H., Dankmeyer Prosthetic Appliance Center, Inc., Baltimore, Maryland. |
| BOODEN, Jacobus, J. Booden Ortho. Supply Co., Norfolk, Virginia.           | DILLARD, John E., J. E. Hanger Inc., Nashville, Tennessee.                               |
| BOSETTI, Eugene J., House of Bidwell, Inc., Milwaukee, Wisconsin.          | DILLEE, Ivan A., New York University Prosthetics Education.                              |
| BOTKO, George H., George H. Botko Co., Minneapolis, Minnesota.             | ENGLAND, Clauson F., Christopher's Brace & Limb Co., Lubbock, Texas.                     |
| BROWNFIELD, William E., Brownfield's Art. Limb & Brace Shop, Boise, Idaho. | ESCHEN, Fred J., John N. Eschen Co., New York, New York.                                 |



FAWVER, Lee J., W. E. Isle Co., Kansas City, Missouri.

FERRIS, William J., J. E. Hanger, Inc., Raleigh, North Carolina.

FILLAUER, Carlton E., Fillauer Surgical Supplies, Inc., Chattanooga, Tennessee.

FINLAY, Alexander, Doerffinger Art. Limb Co., Milwaukee, Wisconsin.

FRIDDLE, William D., Greenville Orthopedic Appliance Co., Greenville, South Carolina.

GALLO, John C., J. E. Hanger Inc., New York, New York.

GARSCADDEN, Ronald D., Dept. of Veterans Affairs, Prosthetic Services Sunnybrook Hospital, Toronto, Canada.

GEISLER, Herman J., Geisler's Artificial Limbs & Braces, Fond du Lac, Wisconsin.

GODBEY, Asa L., J. E. Hanger, Inc., Miami, Florida.

GOLD, Jack, Arthur A. Beitman, Newark, New Jersey.

GOOCH, Robert O., Dept. Prosthetic & Orthopedic Appliances, Duke Medical Center, Durham, North Carolina.

GRAYDON, Walter B., Birmingham Art. Limb Co., Mobile, Alabama.

GREIMEL, Fred, County Surgical Co., Inc., Brooklyn, New York.

HAINES, Everett F., Winkley Art. Limb Co., Des Moines, Iowa.

HAMPTON, Fred L., Northwestern University, (Prosthetic Research Center), Chicago, Illinois.

HANSBROUGH, Robert W., J. C. Lloyd Art. Limb Co., York, Pennsylvania.

HARVEY, Robert E., Harvey's Inc., Columbus, Georgia.

HEDGES, Stanley E., Indianapolis Art. Limb Corp., Indianapolis, Indiana.

HELDRETH, Joseph A., Clarksburg Artificial Limb Co., Clarksburg, West Virginia.

HINNANT, John D., W. T. Hinnant Co., Charlotte, North Carolina.

HOLLAND, Bernard G., Jr., Hattiesburg Artificial Limb Co., Hattiesburg, Mississippi.

JESSWEIN, Siegfried W., Northwestern University (Prosthetics School), Chicago, Illinois.

KARG, Ferdinand J., Karg Prosthetics Co., Hollywood, California.

KARSTEN, Ludwig F., Orthopedic Appliance Co., Inc., Milwaukee, Wisconsin.

KINMAN, George I., J. E. Hanger of Canada Limited, Ontario, Canada.

KONCAK, Frank A., Binghamton Limb & Brace, Binghamton, New York.

LEIMKUEHLER, Paul E., Paul Leimkuehler, Inc., Cleveland, Ohio.

LETNER, Ivan E., J. E. Hanger, Inc., Washington, D. C.

LOCKE, Richard M., J. E. Hanger, Inc., Orlando, Florida.

LUCKETT, James N., Falls City Limb & Brace Co., Louisville, Kentucky.

MADSEN, Lorrin H., Winkley Co., Minneapolis, Minnesota.

MAPLES, Thomas L., J. E. Hanger, Inc., New Orleans, Louisiana.

MARTINO, Joseph H., United Limb & Brace Co., Inc., Boston, Massachusetts.

MASSEY, Martin D., J. E. Hanger, Inc., Baltimore, Maryland.

McCALL, William C., McCall-Cassidy Prostheses, St. Petersburg, Florida.

McCLUGGAGE, Carl S., Snell's Artificial Limb & Brace Co., Inc., Johnson City, Tennessee.

McDOUGALD, Egbert L., Snell's Limbs & Braces, Inc., Baton Rouge, Louisiana.

MEYER, Theodore C., D. R. Coon Company, Detroit, Michigan.

MUILENBURG, Alvin L., Muilenburg Artificial Limb Co., Houston, Texas.

MURKA, Heinz P., Fidelity Orthopedic, Inc., Dayton, Ohio.

NIEHUUS, Herbert E., Scranton Artificial Limb Co., Inc., Scranton, Pennsylvania.

PATE, Vernon T., Tri-State Limb & Brace Co., Memphis, Tennessee.

PAUL, Luby M., Jr., Delta Limb Co., Inc., New Orleans, Louisiana.

RABB, Mitchell D., J. E. Hanger, Inc., Jacksonville, Florida.

RESICO, Neil E., Charleston Artificial Limb Co., Charleston, West Virginia.

ROSSER, Jefferson D., J. E. Hanger Co., Inc., Savannah, Georgia.

ROY, Armand L., Roy's Orthopedic Appliances, Burlington, Vermont.

SABOLICH, Lester J., Sabolich Artificial Limb Co., Oklahoma City, Oklahoma.

SCARLOTT, Forrest T., Jr., J. E. Hanger, Inc., Tampa, Florida.

SCOVILLE, George A., Scoville Artificial Limb Co., Hartford, Connecticut.

SEALS, Daniel J., J. E. Hanger Co., Montgomery, Alabama.

SMITHERMAN, Moody L., Birmingham Artificial Limb Co., Birmingham, Alabama.

STANFORD, James W., J. E. Hanger, Inc., Birmingham, Alabama.

SUMIDA, Carl T., Child Amputee Project, UCLA, Los Angeles, California.

SWIMM, James A., J. E. Hanger Inc., Charleston, West Virginia.

THRANHARDT, Howard R., J. E. Hanger Inc., Atlanta, Georgia.

TITUS, Bert R., Duke Medical Center, Durham, North Carolina.

TYO, Howard J., Frees and Tyo, Inc., Syracuse, New York.

WARD, George D., The I. P. Boggs Co., Huntington, West Virginia.

WATTERS, Gene E., Modern Limb & Brace Co., Harrisburg, Pennsylvania.

Williams, Robert M., Lone Star Artificial Limb Co., San Antonio, Texas.

WRIGHT, Charles W., J. E. Hanger of Philadelphia, Inc., Philadelphia, Pennsylvania.

## APPENDIX B

### SUMMARY OF METHODS OF MEETING A BASIC VA CONTRACTUAL REQUIREMENT FOR FURNISHING FLUID-CONTROLLED DEVICES

(Covering Period November, 1959-June, 1962)

#### 1. HYDRA-CADENCE PROSTHESIS ONLY.

- a. Satisfactory completion of one or more of the following full-time intensive courses at UCLA:

Above-Knee Prosthetics	November 2-20, 1959 February 20-March 10, 1961
Below-Knee Prosthetics (Included Advanced AK during the last week)	November 30-December 18, 1959 January 4-22, 1960 February 15-March 4, 1960 March 21-April 8, 1960 April 25-May 13, 1960
Advanced Clinical Prosthetics: Above- Knee Amputations	September 5-9, 1960 November 28-December 2, 1960 January 9-January 13, 1961

OR

- b. Authorized participation in the VA Clinical Application Study of the Hydra-Cadence Above-Knee artificial leg, which involved the fitting or the supervision of the fitting of at least one Hydra-Cadence Prosthesis accepted as satisfactory by the cognizant VA Orthopedic and Prosthetic Appliance Clinic Team.

#### 2. HYDRA-CADENCE, HENSCHKE-MAUCH MODEL "B," DUPACO HYDRAULIC UNITS AND UC-B PNEUMATIC UNIT.

- a. Satisfactory completion by graduates of university-level above-knee courses for prosthetists of at least one of the following seminars on fluid-controlled devices

(1) Miami Beach:	October 26-28, 1961
(2) UCLA:	January 26, 1962
(3) New York:	February 19-21, 1962
(4) UCLA:	March 23, 1962
(5) Salt Lake City:	May 31, 1962-June 2, 1962

OR

- b. Satisfactory completion of either of the following above-knee prosthetics courses for prosthetists:

(1) UCLA:	March 5-30, 1962
(2) Northwestern University:	March 19, 1962-April 6, 1962