DECEMBER 1968

orthotics and prosthetics

american orthotic &


prosthetic association

orthotics and prosthetics

THE JOURNAL OF THE ORTHOTIC AND PROSTHETIC PROFESSION

VOLUME 22
NUMBER 4
DECEMBER 1968

Contents

Editor
Audrey J. Calomino

Orthotics and Prosthetics: The Orthopedic and Prosthetic Appliance Journal is issued in March, June, September and December. Subscription price, payable in advance, is five dollars a year in the Western Hemisphere, rate elsewhere is six dollars a year. Publication does not constitute official endorsement of opinions presented in articles. The Journal is the official organ of its publisher, The American Orthotic and Prosthetic Association. All correspondence should be addressed to: Editor: **Orthotics and Prosthetics**, 919 18th St., N.W., Washington, D.C. 20006. Telephone, Area Code 202, 296-4160.

second class postage paid at Washington, D.C. and at additional mailing offices

THE AMERICAN ORTHOTIC AND PROSTHETIC ASSOCIATION

OFFICERS

President—**Michael P. Cestaro**
Washington, D. C.

President-Elect—**William L. Bartels,** C.O.
Portland, Oregon

Vice President—**Richard G. Bidwell,** C.P.O.
Milwaukee, Wisconsin

Secretary-Treasurer—**Durward R. Coon,** C.P.O.
Detroit, Michigan

Immediate Past President—**Alvin L. Muilenburg,** C.P.O.
Houston, Texas

REGIONAL DIRECTORS

Region I—**Robert F. Hayes,** C.P.
Hartford, Connecticut

Region II—**Mary Dorsch,** C.P.O.
New York, New York

Region III—**Hans F. Christoph,** C.P.O.
Philadelphia, Pennsylvania

Region IV—**J. D. Ferguson,** C.P.O.
Chapel Hill, North Carolina

Region V—**Robert E. Fannin,** C.O.
Columbus, Ohio

Region VI—**William A. Sobbe,** C.P.
Chicago, Illinois

Region VII—**Betty M. Hanicke,** C.O.
Kansas City, Missouri

Region VIII—**Robert V. Bush,** C.P.O.
Albuquerque, New Mexico

Region IX—**C. Richard Fadley,** C.P.
Santa Monica, California

Region X—**Matthew G. Laurence,** C.P.O.
Oakland, California

Region XI—**Morris A. Dodge,** C.P.
Seattle, Washington

AMERICAN BOARD FOR CERTIFICATION IN ORTHOTICS AND PROSTHETICS, INC.

President—**Ralph R. Snell,** C.P.
Memphis, Tennessee

President-Elect—**Samuel E. Hamontree,** C.P.
Syracuse, New York

Vice President—**Edward T. Haslam,** M.D.
New Orleans, Louisiana

Secretary-Treasurer—**Robert E. Fannin,** C.O.
Columbus, Ohio

Immediate Past President—**Paul Leimkuehler,** C.P.
Cleveland, Ohio

Raymond J. Pellicore, M.D.
Chicago, Illinois

Augusto Sarmiento, M.D.
Miami, Florida

Herbert B. Warburton, Executive Director

Audrey J. Calomino, Asst. Executive Director

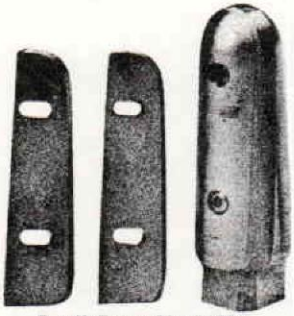
Index of Advertisers

December 1968


The Season's Greetings
from
The Members, Officers
and Staff
of
The American Orthotic
and Prosthetic Association

TRAUTMAN CARVER ATTACHMENTS

CUTTERS



Small Cutter No. 2100A.
No. 2100AB Blades

Large Cutter No. 2100B.
No. 2100BB Blades

Sharpened for one-half cost of a new set of blades, plus postage.

Carver # 2100
Foot Switch
 # 2100K

Midget Cutter
 # 2100H (including an extra blade)

ATTACHMENTS

Medium Sand Core No. 2100C. Medium size abrasive cones Coarse Cone No. S41D, Fine Cone No. S41E.

Rasp No. 2100E. We resharpen the Rasp for one-half cost of new, plus postage.

Small Sand Core No. 2100D. Small size abrasive cones only. Coarse Cone No. S41H, Fine Cone No. S41G.

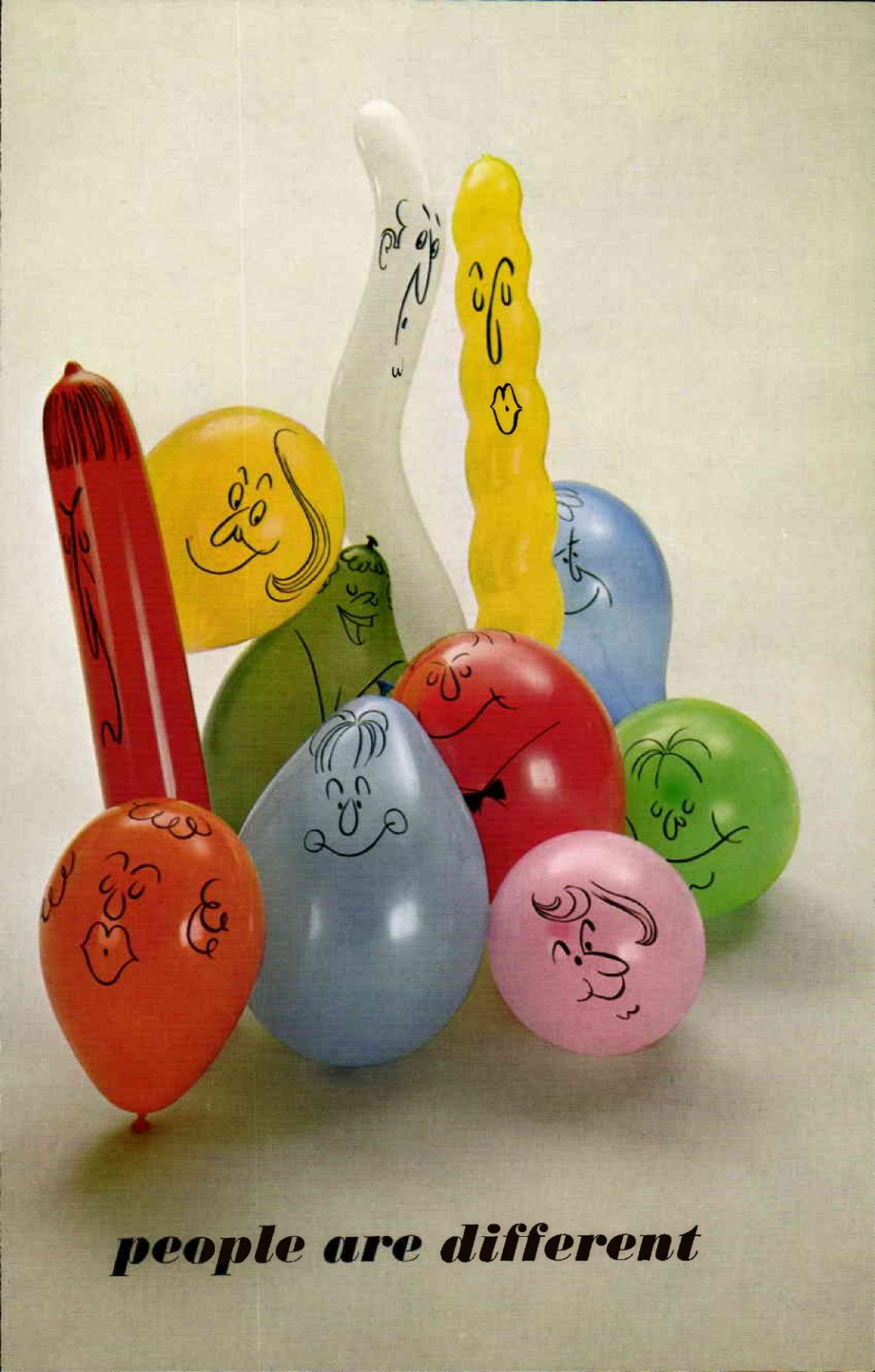
Small Sand Drum No. 2100F. Small size abrasive sheets. Coarse No. S41T. Fine No. S41U.
No. 2100FF—Flat Sides.

Large Sand Drum No. 2100G. Large size abrasive sheets. Coarse S41V, Fine S41W.

Write for price and delivery date

TRAUTMAN'S

410 Portland Avenue, Minneapolis, Minn. 55415


people are different

every CAMP *style*

is a line within a line

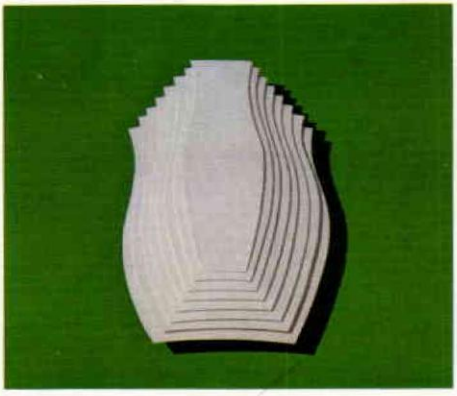
Take Lumbosacral supports for instance. The basic problem in Lumbosacral support design is fit. That's because the support covers such a wide area.
Only Camp creates enough models to fit any figure type—whatever the difference.

Enough fabrics for any taste

Rayon figured cotton jacquard. Cotton warp sateen. Dacron and cotton mesh. Coutil. Surgical elastic. Lycra®. Nylon lace. To name a few. And we're experimenting with new fabrics right now.

Enough models for a perfect fit.

Camp offers over 30 different Lumbosacral models for women, over 20 for men. That's fifty. Multiply that by a complete size range. How many does that make? Over 400. Even we never figured out the exact amount. We know it's enough. Sixty years of perfect fit proves it.



Enough designs for any treatment

Front lace, side lace, back lace. Double adjustment. Triple. Snap button front, zipper, slim line hook adjustment. Two steels. Four steels. In any and all combinations. When it comes to design you can give your customers what is needed and what the doctor ordered. That's Camp.

CAMP TRADE MARK

S. H. CAMP & COMPANY, Jackson, Michigan 49204

1908-1968 . . . sixty years of service and still growing strong

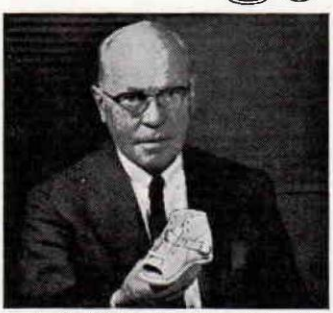
Your major selling point . . .

Doctors Prescribe CHESBROUGH Orthopedic Pre-Walkers

No. 1400 OPEN TOE
Straight-line symmetrical last, firm heel, no back seam. Adaptable to Denis Browne Splints.

No. 1300 CLOSED TOE
Lace-to-toe design permits snug, gentle fit. Perfectly smooth inside.

No. 1700 CLUBFOOT, OPEN TOE
Special outflare last, sturdy instep strap to stabilize heel.



Louis C. Weld, Founder of G. W. Chesbrough Co. . . . "My own personal experience led to the development of the new Chesbrough Shoe."

This is the reason Chesbrough Orthopedic Shoes have had such spectacular success. Orthopedic surgeons in 50 states and many foreign countries are now prescribing them. This large referral business continues to grow and we invite you to share in it.

Any parent whose child requires orthopedic correction will tell you the expense is great, as frequent purchase of new shoes is required.

This problem was brought home to Chesbrough's founder, Louis C. Weld, several years ago, when a child in his own family needed such a shoe. Recognizing the need for orthopedic shoes at an economical price, Chesbrough put their 68 years of shoemaking experience to work and Chesbrough Corrective Pre-Walker Shoes were born.

Here is a shoe of highest-quality workmanship and fine leathers, made to sell at a moderate price.

All shoes in unlined white elk, sizes 000 to 4, narrow and wide. Available in full pairs, split pairs or single shoes (no extra charge for half pairs).

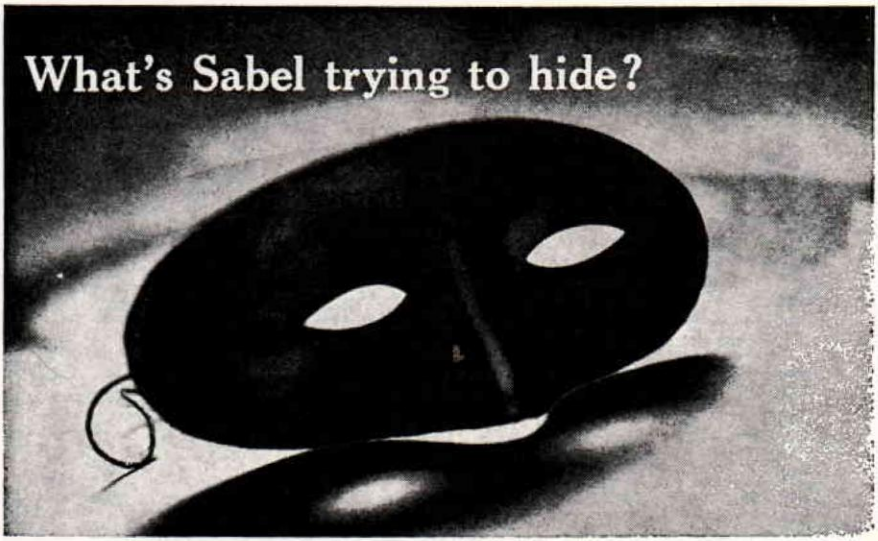
MAIL COUPON FOR SAMPLES

G. W. CHESBROUGH CO.
797 Smith Street, Rochester, N. Y. 14606

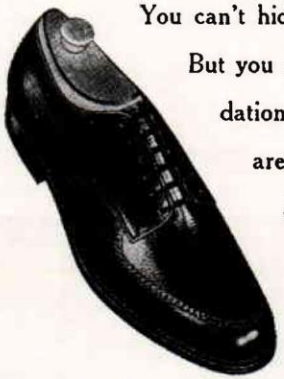
NAME.....

ADDRESS.....

CITY..... STATE..... ZIP.....



They're normal looking-They're normally priced



You can't hide the fact that some feet require special attention. But you can mask many foot defects with special accommodation in Sabel shoes that consider the displacement of area within the shoe and fit the foot without restriction. Shoes that are ruggedly built to stand the strains and stresses of corrective work. That feature heavy ribbed, flanged right and left steel shanks, Thomas heels, finest oak bend oil-treated soles to accept bracework, if required, and all prescribed corrections. So, what's a specially constructed shoe like this going to cost the customer? Just about what you'd expect him to pay for any pair of fine shoes. Sabel made it possible.

SINGLE SHOES OR SPLIT SIZES ALWAYS AVAILABLE

SABEL'S

BASIC SHOES

TRADE MARK REG. U. S. PAT. OFF.

SABEL DIVISION, C.H. ALDEN SHOE COMPANY, BROCKTON, MASS.

1968 CERTIFICATION EXAMINATION RESULTS

The following candidates for Certification in Orthotics and Prosthetics have successfully completed the 1968 Certification Examinations held recently in New Orleans, Louisiana. Our congratulations are extended to each of them and we wish them every success in their future work.

Orthotics

Ivan Hunsinger
Carl D. Brenner
Vincent D. Masciarelli
Robert L. VanZandt
Henry K. Saur
Larry A. Rose
Edward G. Carlson
Philip J. Leonard
Dennis E. Elrod
David M. Ford
Carl W. Dorman
Tommy R. Hamil
Jack B. Spring
Joseph M. Cestaro
Glen D. Davis, Jr.
Albert E. Feldman
Alan R. Finnieston
Richard Koch
Roy Laughlin
M. L. Smitherman
Jack R. Milbourn
Freddie Pearson
Jack Pounders
John A. Roberts
Frederick Sosnoff
Edward E. Tougas
Nicholas J. VanHanswyk
Lucian B. Williams
James Aylen
Neil A. Williams

Prosthetics

Roy Snelson
David Porter
Kenneth E. Reeser
David Carr
Charles Gano
Jack Virando
Ivan R. Sabel
Jerry Casson
Charles A. Conroy
Cecil E. McMorris
Keith Vinnecour
Benjamin Pulizzi
Charles Dankmeyer, Jr.
Morton Levy
Jean Fleetwood
Edward J. Sulima, Jr.
Stanley A. Norell
Herbert W. Marx
Harold S. Kramer
Donald W. Olson
Mark E. Schultz
David N. Dupree
Samuel Polsky
Thomas Vitale
John L. Stonecipher
Alfred Schnell
Kenneth M. Woodward
Robert F. Stowe

Wheelchair Acceleration Limiter

by

Edwin M. Prentke, B.S.[1] and Barry Romich, B.S.[2]

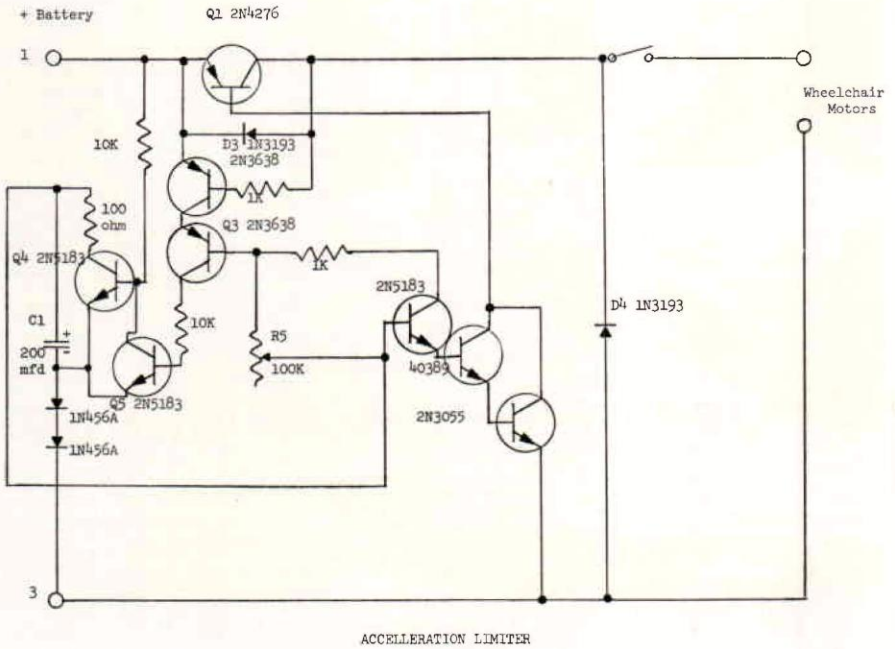
Users of electric wheelchairs at Highland View Hospital have objected to the sudden acceleration that accompanies starting because it causes the head and trunk to jerk backwards. In order to overcome this problem, the solid-state circuit shown in Figure 1 was designed and tested. Since we use the Everest and Jennings electric wheelchairs, the circuit was made especially to limit the rate of acceleration of these chairs.

Results have been gratifying, and we plan to make these devices available to all future electric wheelchair patients who are admitted to our Physical Medicine & Rehabilitation Department.

Current from the wheelchair batteries is supplied to the motors through a silicon power transitor Q1, which does not conduct until capacitor C1 begins to charge. When the wheelchair is started, current and motor speed increase gradually over a period of time determined by the externally controlled potentiometer R5, and the capacitor C1. This time constant is adjustable from zero to a few seconds, so that the user has a wide choice of acceleration rates. When the control stick is operated in any desired direction, power is applied and capacitor C1 begins to charge. As the charge builds up, current flows gradually into the base of transistor Q1, and collector current also starts to flow through the transistor into the

[1]Ampersand Research Group, Department of Physical Medicine & Rehabilitation, Highland View Hospital, Cleveland, Ohio 44122.

[2]Design Engineer, Engineering Design Center, Case Western Reserve University, Cleveland, Ohio 44106.



ACCELLERATION LIMITER

FIGURE 1

motors. The duration of the acceleration cycle depends on the values of C1, R5, and other components. These values are all fixed, except R5, so that the latter controls the rate of acceleration.

In time-delay circuits of this type, the capacitors have to be discharged before the system is ready to be cycled again. In this application a wheelchair would start gradually the first time but, if stopped and started again quickly, the capacitor would still retain some charge, and prevent the circuit from functioning properly again. In the circuit of Figure 1, transistors Q3, Q4, and Q5 are used to discharge C1 as soon as the wheelchair has stopped, permitting the acceleration control to be recycled instantly.

FIGURE 2

Diodes D3 and D4 have been included to prevent damage to

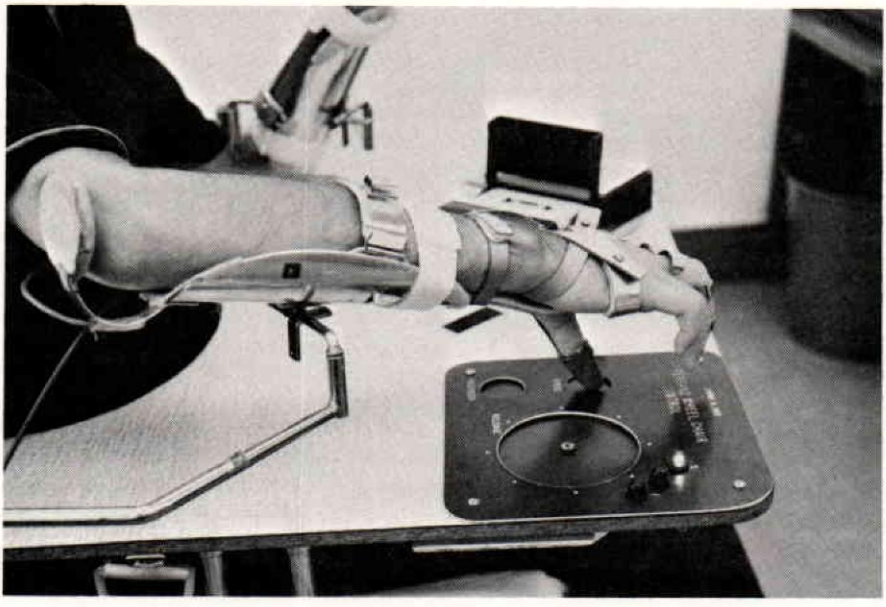


FIGURE 3

the transistors from switching transients.

Several of these units are presently in use at Highland View by persons who were formerly hospital patients and who use the equipment at home. Some units are installed on chairs having the original factory supplied controls, and others on chairs which were modified so they could be used by quadriplegic and other severely handicapped persons. This system is illustrated in the photographs of Figure 2 and Figure 3. Control of both speed and direction is done by pressing very lightly on touch-plates having microswitches under them. These switches actuate power relays that are connected to the motor circuits.

The acceleration limiter unit, measuring 5″ × 4″ × 2″ and weighing less than two pounds, is now available commercially. It is mounted next to the junction box, and requires the connection of only three leads. In the modified wheelchair controls the components of the limiter are located inside the relay box behind the wheelchair.

All of the units constructed so far have been operating without failure since the first one was installed in January, 1968.

Hydraulic Crutch as a Source of Internal Power for Orthotics and Prosthetics

by
Paul J. Corcoran, M.D.,[1]
Raymond Taggart, Ph.D.,[2]
Lester W. Brown, B.S.,[3] and
Bernard C. Simons, C.P.[4]

INTRODUCTION

Non-powered, or passive, orthotic and prosthetic devices have been used since antiquity. Acceleration, deceleration, or the momentum of more proximal portions of the limb provide their motive force.

In recent years, external power has come into use for driving assistive devices (1,2). Compressed gas and electricity are the power sources most commonly used at this time. Problems of control are probably the severest limitations to the application of external power systems (3).

There has been less exploitation of potential sources of internal power obtained from intact

[1] Assistant and Senior Fellow, Department of Physical Medicine and Rehabilitation, School of Medicine, University of Washington. (Presently Assistant Professor, Department of Rehabilitation Medicine, College of Physicians and Surgeons of Columbia University, New York, N.Y. 10032).

[2] Associate Professor, Department of Mechanical Engineering, University of Washington, Seattle, Washington.

[3] Graduate Student, Department of Mechanical Engineering, University of Washington, Seattle, Washington.

[4] Director, Prosthetic-Orthotic Laboratory; Instructor, Department of Physical Medicine and Rehabilitation, School of Medicine, University of Washington, Seattle, Washington.

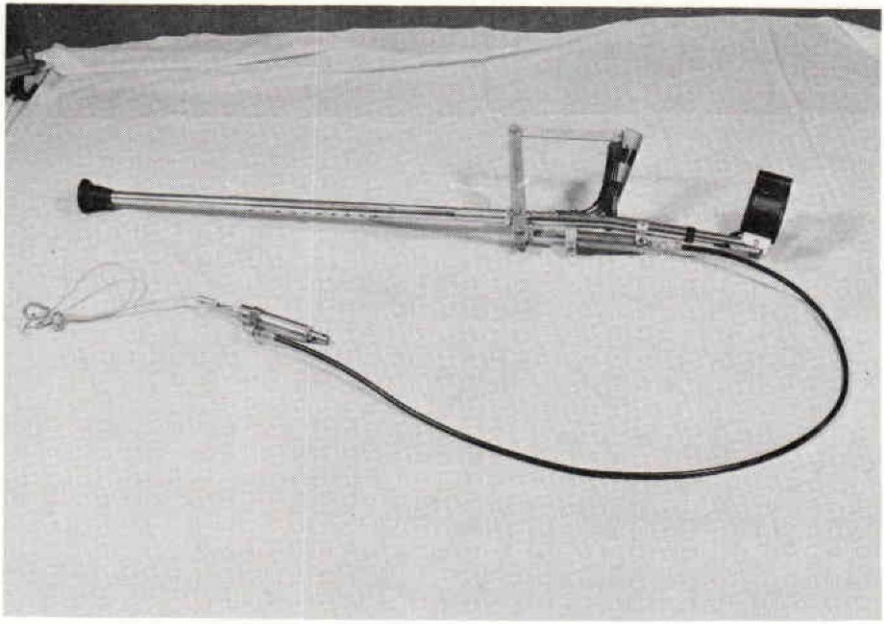


FIGURE 1—Downward pressure on the crutch handgrip results in movement of a piston into the master cylinder, directly linked to a slave cylinder by flexible hydraulic tubing. Improved models should have the master cylinder mounted inside the shaft of the crutch.

parts of the body to operate assistive devices. Control of internal power is easier to learn, and its use avoids the expense and inconvenience of recharging the storage batteries or the gas cylinders of an external power source. A common example is the use of shoulder flexion and protraction to power the terminal device of an upper-extremity prosthesis. Another use of internal power is found in the Hydra-Cadence prosthesis (4), where hip flexion provides power that is transmitted hydraulically from the passively flexing prosthetic knee and results in ankle dorsiflexion. Feasibility studies have been reported on the use of heartbeat and respiratory motions to power a cardiac pacemaker (5), and the compression of a piston in the shoe heel to power an upper-extremity prosthesis (6).

Description of Hydraulic Crutch

This paper is a preliminary report of efforts which began in July, 1967 to obtain internal power by means of a cylinder and piston mounted in a crutch. Figure 1 shows an experimental model of an aluminum forearm crutch fitted with a master cylinder whose piston is activated by leaning on the handgrip. Hydraulic fluid transmits the power directly to a slave cylinder that is attached to the body in a position where the piston motion can provide a useful force.

Figure 2 shows a pair of hydrau-

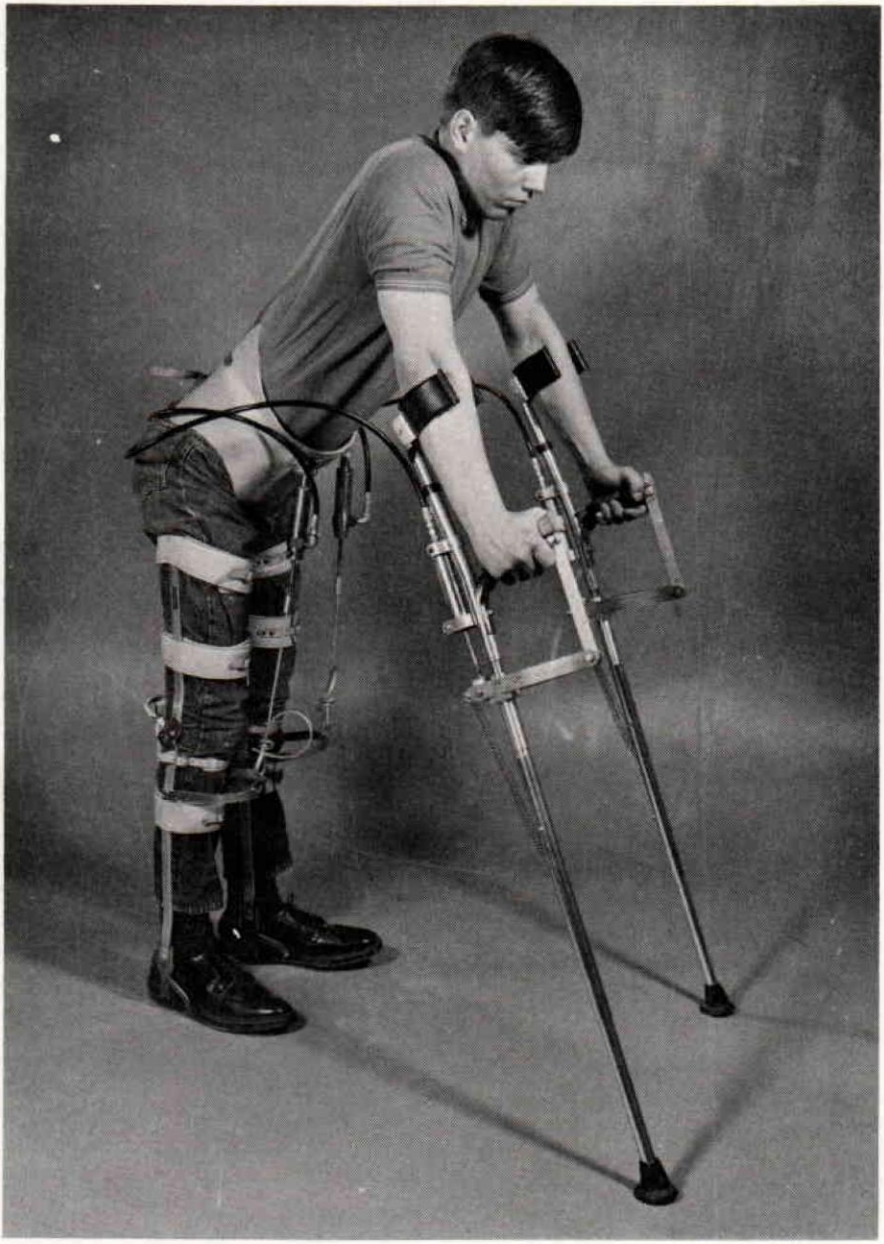


FIGURE 2—Paraplegic patient using two hydraulic crutches. To assist in performance of the four-point gait pattern, weight-bearing on the right crutch assists flexion of the left hip, and vice versa.

lic crutches whose slave cylinders flex the opposite hips and extend the knees of a paraplegic patient. This arrangement permits internal powered assistance in the performance of a four-point gait. Another application under study is in unilateral hip disarticulation,

to assist flexion of the hip of a Canadian prosthesis.

DISCUSSION

Much additional developmental research is needed to make such a system practical. The optimum internal power device should have high efficiency to conserve the limited human power output; rapid response to deliver the power precisely when it is needed; ease of control so that natural gait movements will automatically trigger it; the capability to store power temporarily; and the avoidance of unnecessary up-and-down movement of the patient's center of gravity when activating the system.

The ideal internal power source for a hydraulic system would probably be a master cylinder and piston which *decelerated* an unwanted movement and resisted the entire weight of the body. For example, paralyzed quadriceps femoris function could be replaced by a cylinder whose piston motion would pressurize hydraulic fluid, thus resisting the tendency of the knee to buckle, while at the same time providing power which could be used elsewhere. An air pressurized hydraulic accumulator would be the most convenient component for power storage.

SUMMARY

Internal power for orthotics and prosthetics is discussed as an intermediate stage between external power and no power. Preliminary work is described on a hydraulic crutch as an internal power source. The requirements to make such a system practical are discussed.

REFERENCES

1. *The Application of External Power in Prosthetics and Orthotics*. Washington, D. C., National Academy of Sciences–National Research Council Publication 874, 1961, pp. 156.
2. *Symposium on Application of External Power to Artificial Limbs and to Splints*. **J. Bone Joint Surg. 47-B:** 399–471, Aug. 1965.
3. *The Control of External Power in Upper-Extremity Rehabilitation*. Washington, D. C., National Academy of Sciences-National Research Council Publication 1352, 1966, pp. 369.
4. Anderson, M. H., Bechtol, C. D., and Sollars, R. E.: *Clinical Prosthetics for Physicians and Therapists*. Springfield, Illinois, Charles C Thomas, Publisher, 1959. p. 364.
5. Parsonnet, V., Myers, G., Zucker, R., and Lotman, H.: *The Potentiality of the Use of Biologic Energy as a Power Source for Implantable Pacemakers*. **Ann. N.Y. Acad. Sci. III:** 915–921, June 1964.
6. McLeish, R. D.: A *Design Study of a Hydraulically Operated Artificial Arm Powered by Normal Walking*. **Med. Biol. Engng. 6:** 3–17, 1968.

A Fluid Resin Technique for the Fabrication of Check Sockets

by
Peter M. Margetis, Col, DC,[1]
Walter L. Shepard, LTC, DC,[2]
Robert E. Plumb, CP,[1]
and Fred Leonard, Ph.D.[1]

INTRODUCTION

During walking, a below-knee amputee fitted with a patellar tendon bearing socket will experience a continually changing set of stump socket forces both of an anterioposterior and medial-lateral nature. For successful fitting, therefore, it is necessary to resolve the stump socket forces in such a way as to provide for both comfortable support and adequate stabilization throughout the walking cycle (1).

[1] U. S. Army Medical Biomechanical Research Laboratory, Walter Reed Army Medical Center, Washington, D. C. 20012
[2] U. S. Army Regional Dental Activity, Walter Reed Army Medical Center, Washington, D. C. 20012

Many attempts have been made to measure the distribution of stump socket forces both statically and dynamically but no satisfactory practical limb shop method has evolved. Because of the lack of an accurate method for measuring these forces and the difficulty of achieving a precise fit, prosthetists have had to resort to the use of soft liners to relieve excessive unit pressure, at some sacrifice in stability, or the prosthetist relies upon circumferential measurements of the stump and socket as well as upon the subjective evaluation of the patient to judge adequacy of fit and comfort.

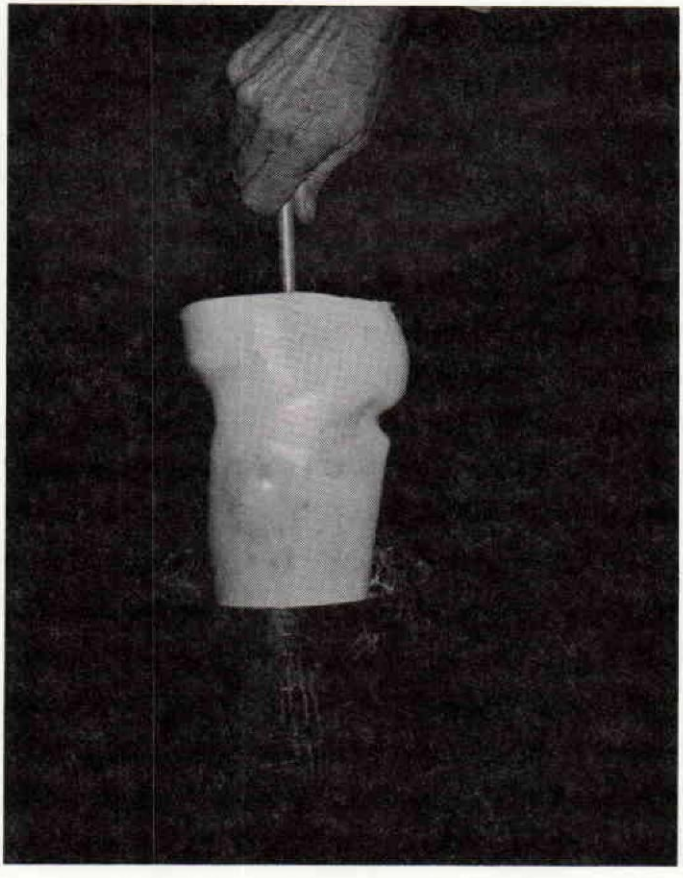


FIGURE 1.—Preparation of wax check socket.

One possible method which may be of help in visualizing the relative distribution of forces in a socket would be through the development of a clear transparent socket. In such a socket, pressure points should be readily observable by soft tissue blanching, thus the effect of various factors which influence stump socket pressures, such as socket fit and alignment of the prosthesis, i.e., location of the foot with respect to the socket, effect of thigh corsets, cuff suspension and side bars may be observed and studied.

In this paper, we report on a method for the fabrication of a transparent below-knee socket.

MATERIALS AND METHODS

After the cast of the amputee's stump is taken and a plaster of Paris positive is poured, a wax check socket consisting of eight layers of stockinet is prepared on the cast by dipping in wax in the usual manner (Fig. 1). The check socket has a thickness of approximately 0.25 inches (Fig. 2).

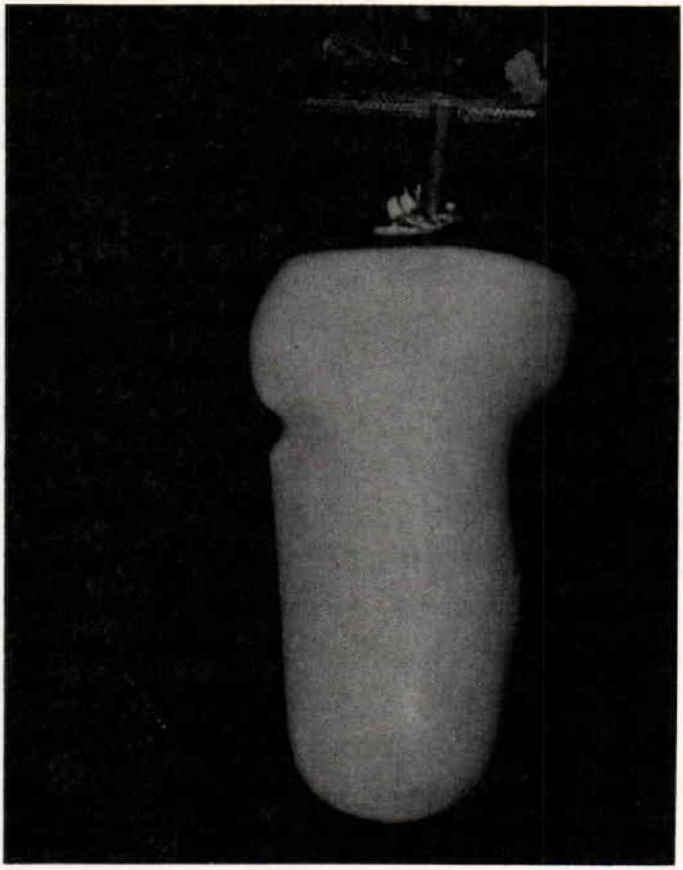


FIGURE 2.—Completed wax check socket.

Next, a negative mold or impression of the wax-coated cast is made using agar-agar duplicating compound. Agar-agar, a hydrophilic colloid extracted from certain types of seaweed, is changed from a gel (solid) to a sol (liquid) with heat.* The gelation or hardening temperature of the agar-agar varies between 86°F and 122°F. The temperature at which the gel changes to the sol ranges between 160°F and 212°F. The agar-agar supplied in one-gallon containers is cut into small pieces and heated to 212°F. The liquid agar-agar, so formed, is cooled to a temperature of 115°F before being poured. After the agar-agar has been prepared, the wax-coated model is then placed in a container and positioned in the center of the container (Fig. 3). The aligning rods (Fig. 4A) are scored and used as reference marks to insure that the model is centered in the same position as it is removed and replaced into the container throughout the procedure. For the purposes of illus-

* Nobiloid Duplicating Material, Mobilium Products, Inc., 125 No. Wabash Avenue, Chicago, Illinois 60602

tration the cross bars (Fig. 4B) have been either removed or replaced by ring stand clamps to allow unobstructed photographs. The liquid agar-agar which has previously been cooled to a temperature of 115°F is now poured into the container holding the wax covered cast (Fig. 5). After gelation of the agar-agar, the wax covered cast is removed from the agar-agar and the wax is cut to a distance of 7 to 8 inches from the distal end of the cast (Fig. 6). The wax is sufficiently elastic to allow removal without fracturing (Fig. 7). The cut ends are then approximated and sealed with a warm wax spatula (Fig. 8). The wax model is then gently replaced into the agar-agar mold from which it had previously been removed (Fig. 9). Next a rod, containing a series of circular discs (Fig. 10) is placed inside the wax model and positioned by using the reference lines used earlier to align the plaster cast. More agar-agar is then poured inside the wax check socket (Fig. 11) and after gelation, is removed (Fig. 12). The circular discs are necessary to prevent the rod from pulling cleanly out of the agar-agar. The wax usually adheres to the agar-agar stump model and is removed by again cutting with a knife. (Fig. 13). The wax at this point is discarded and can be remelted for use in the fabrication of future check sockets as needed. The agar-agar model of the patient's plaster cast is then placed back into the negative agar-agar mold and again positioned using the reference lines on the aligning rods (Fig. 14).

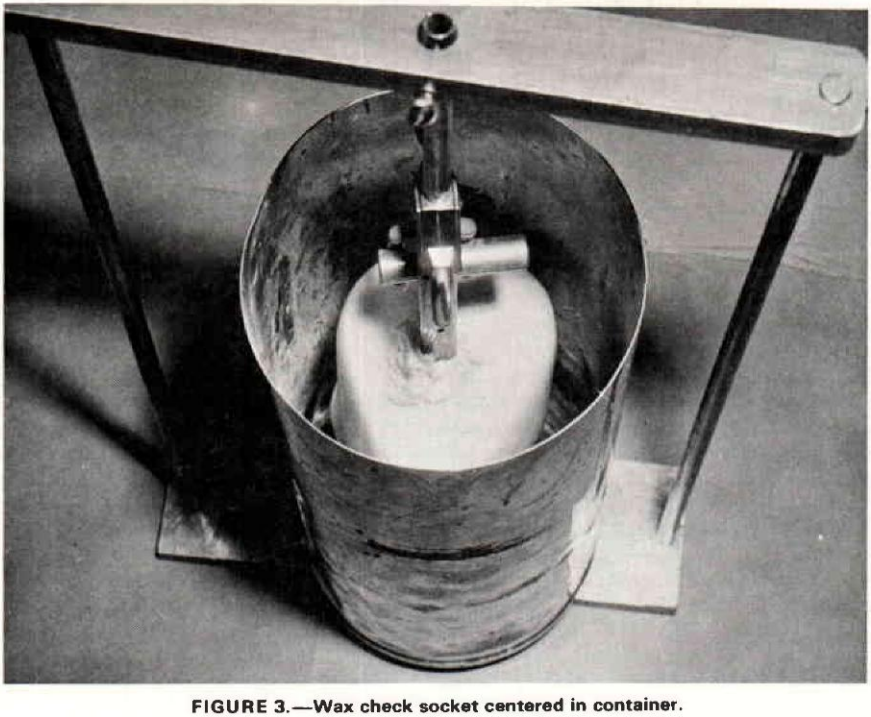


FIGURE 3.—Wax check socket centered in container.

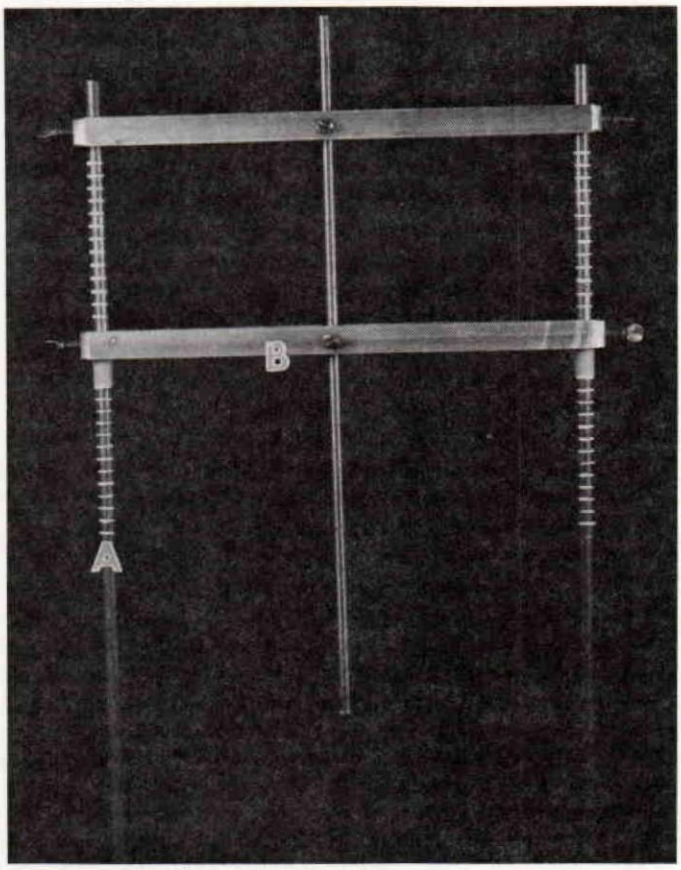


FIGURE 4A.—Scored aligning rods; B—Cross bars.

The transparent socket is fabricated using a poly (methyl methacrylate) syrup† which polymerizes at room temperature by means of chemical initiators and promotors to form poly (methyl methacrylate), a hard synthetic resin which is transparent and of high clarity. The poly (methyl methacrylate) syrup is poured into a beaker to which a white powder, supplied by the manufacturer, presumably benzoyl peroxide, is added and the mixture stirred (Fig. 15). A sheet of Saran wrap is placed over the beaker and the mixture is allowed to stand for 10 minutes. The resin syrup is then poured into the space B, between the agar-agar model of the patient's plaster cast A and the agar-agar matrix C (Fig. 16). The length of time necessary for the check socket to completely polymerize varies according to its size and thickness but an hour is usually sufficient. The agar-agar stump and poly (methyl methacrylate) check socket are removed together from

† Klearmount w/Catalyst, Vernon-Benshoff Co., Inc., 413 No. Pearl St., Albany, N. Y. 12207

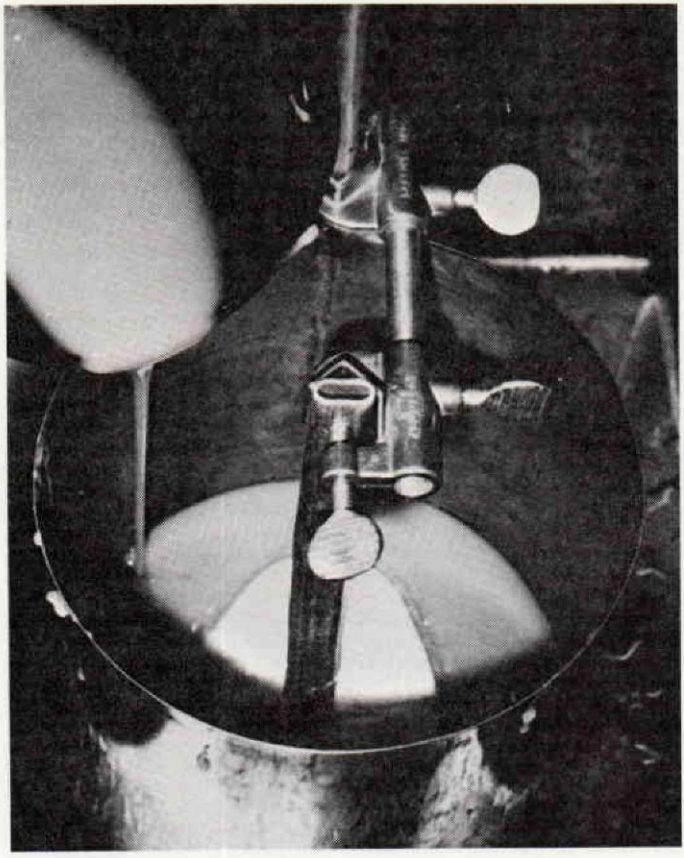


FIGURE 5.—Liquid agar-agar is poured around wax covered cast.

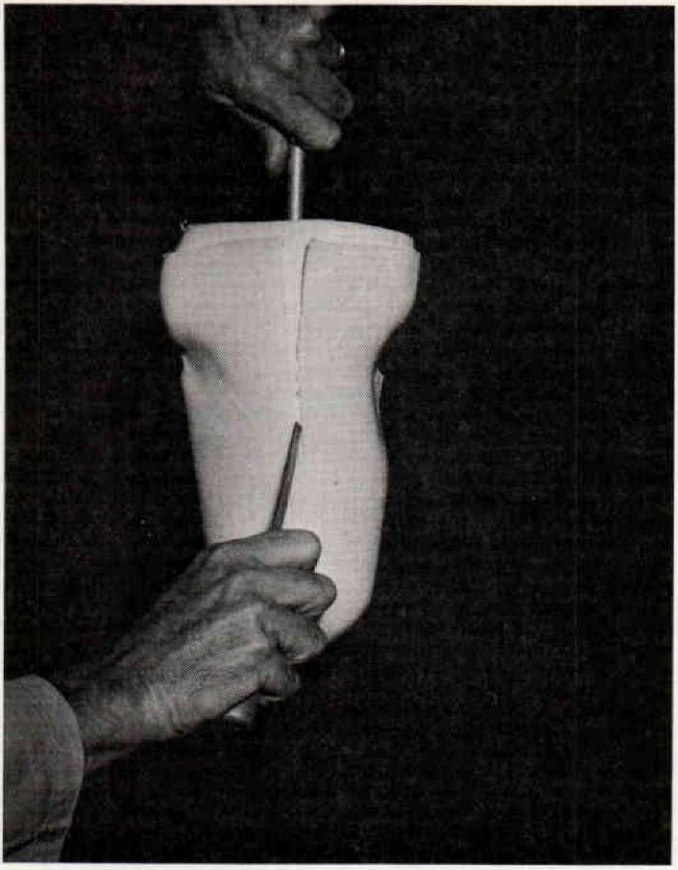


FIGURE 6.—Cutting wax check socket to facilitate removal.

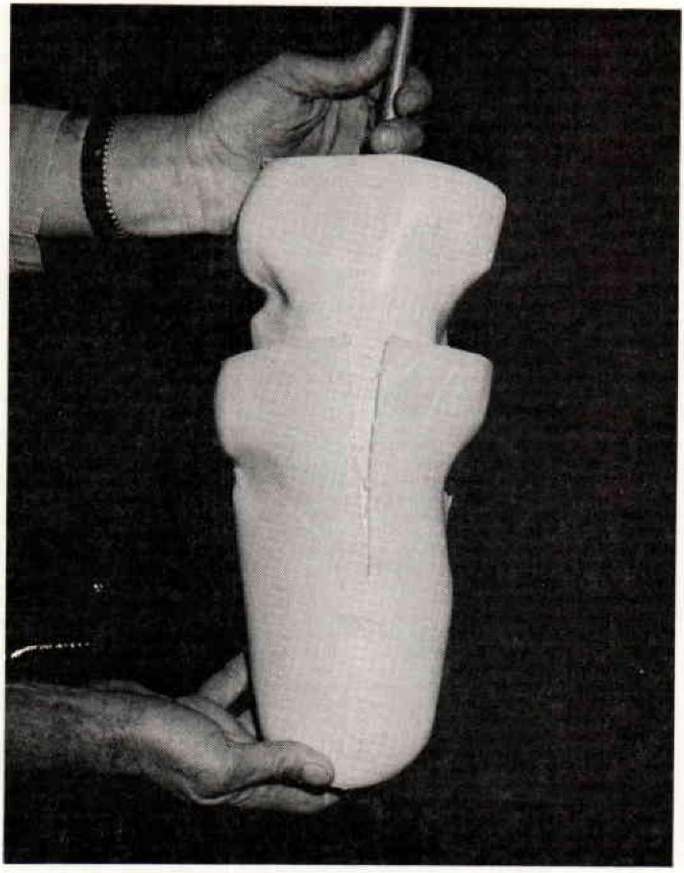


FIGURE 7.—Removal of cut wax check socket.

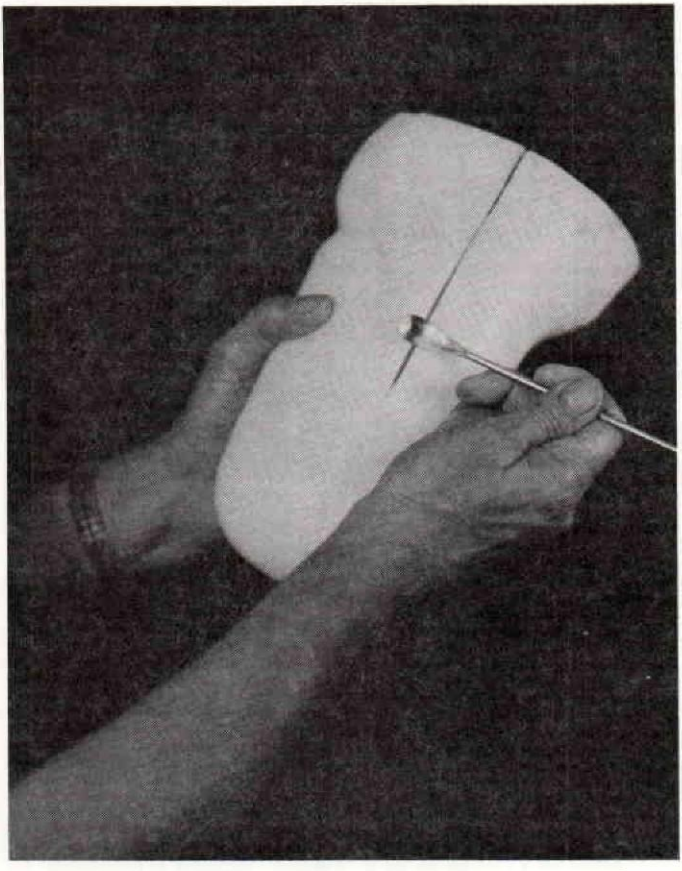


FIGURE 8.—Cut wax check socket is sealed with warm spatula.

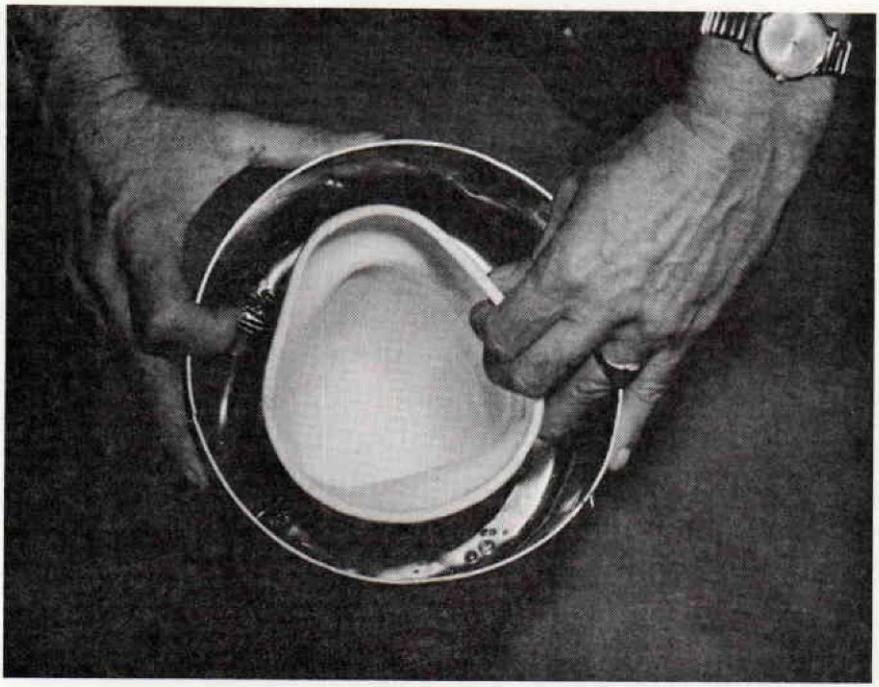


FIGURE 9.—Replacing wax check socket into agar-agar mold.

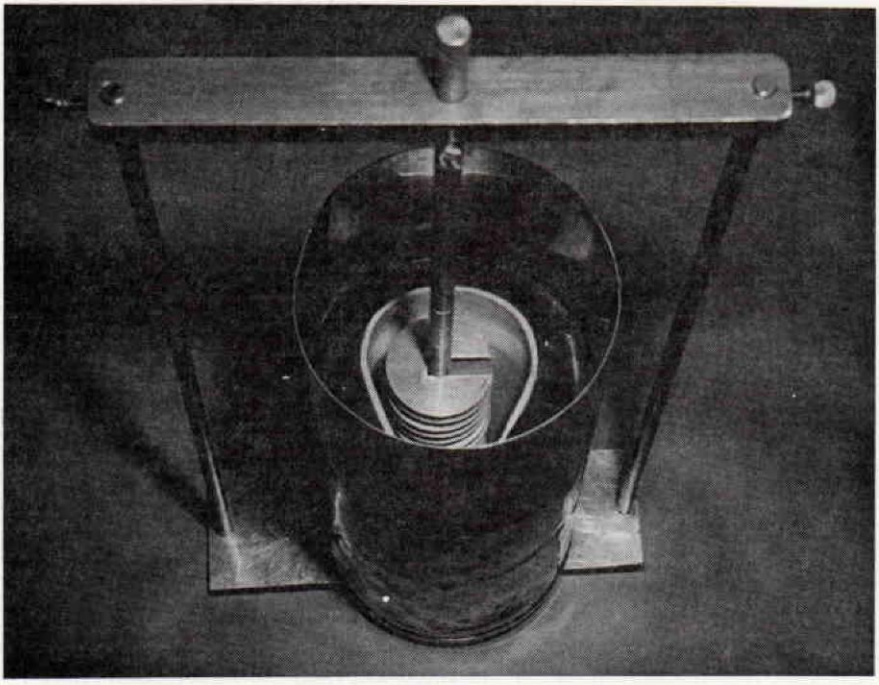


FIGURE 10.—Rod with circular discs is centered inside wax check socket.

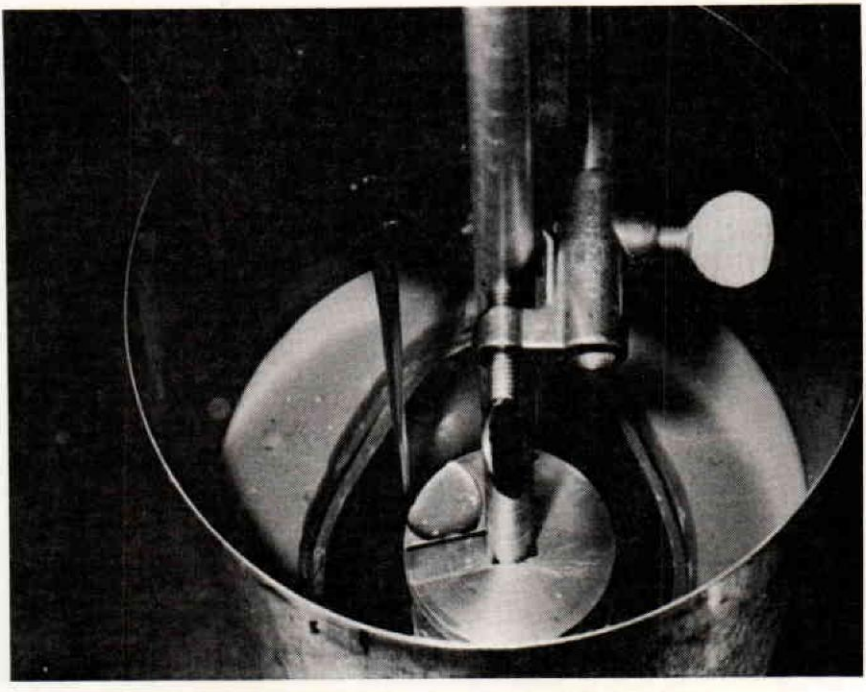


FIGURE 11.—Pouring agar-agar into wax check socket.

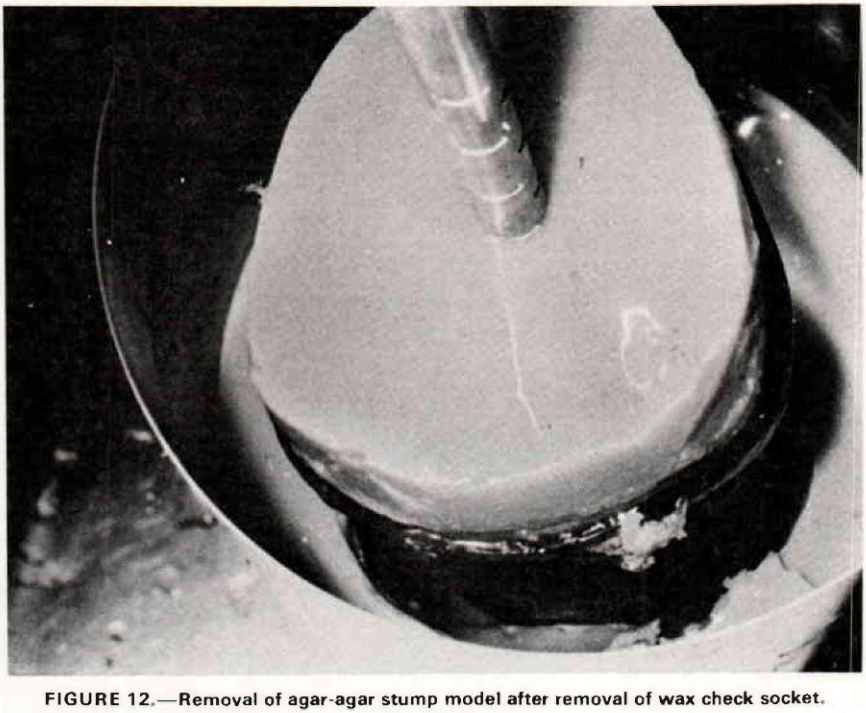


FIGURE 12.—Removal of agar-agar stump model after removal of wax check socket.

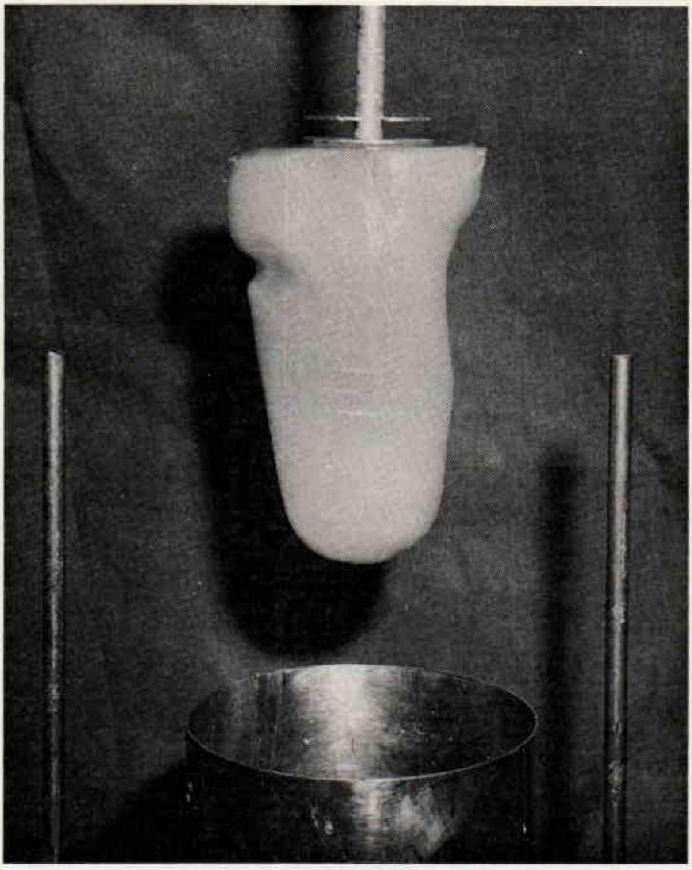


FIGURE 13.—Agar-agar stump model after removal of wax check socket.

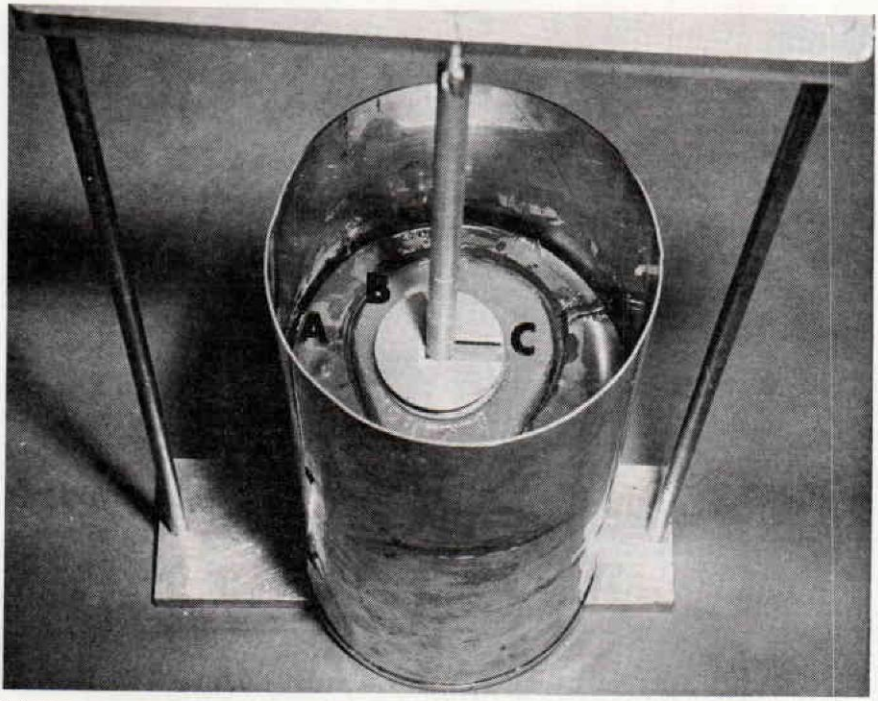


FIGURE 14A.—Outer layer of agar-agar; B.—Space formerly occupied by wax check socket; C.—Agar-agar stump model.

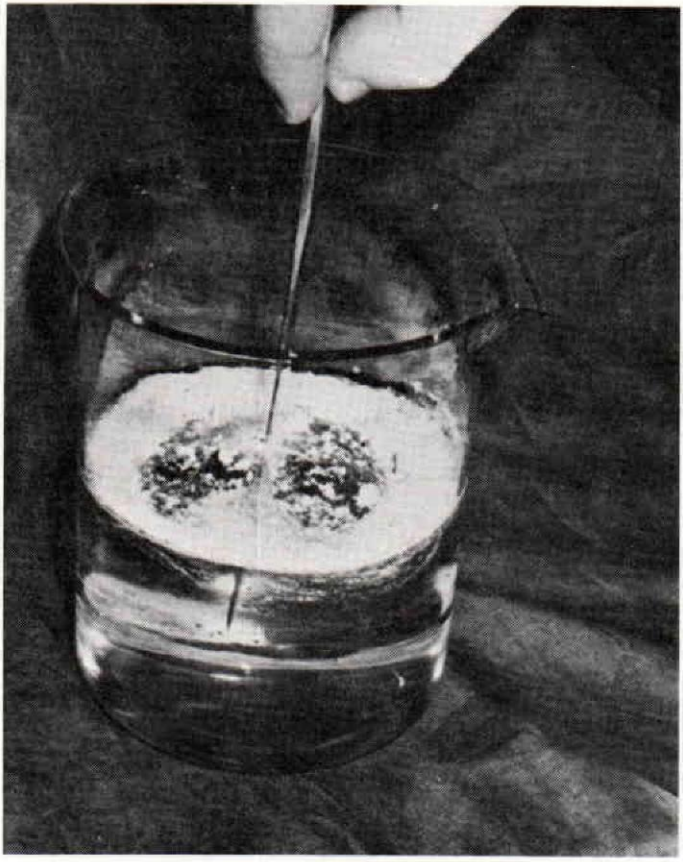


FIGURE 15.—Stirring of catalyst into methyl methacrylate.

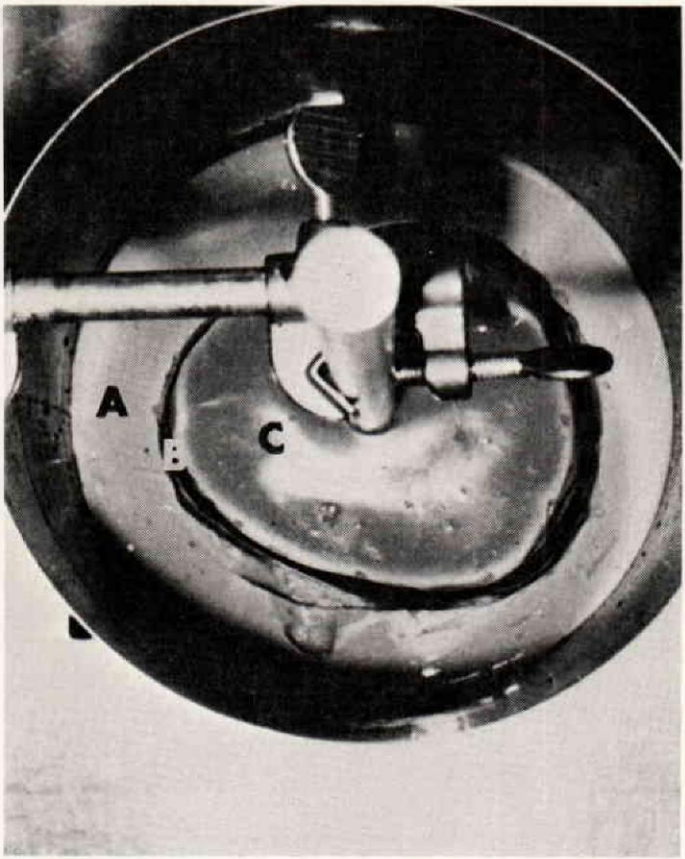


FIGURE 16A.—Outer layer of agar-agar; B.—Methyl methacrylate syrup; C.—Agar-agar stump model.

FIGURE 17.—Agar-agar stump model—A—inside of poly methyl methacrylate check socket—B.

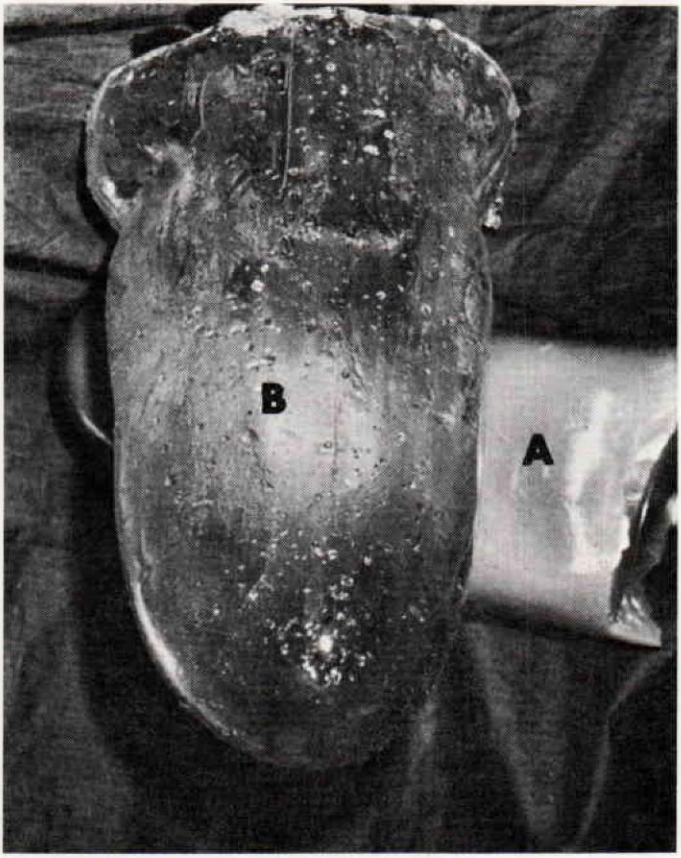


FIGURE 18.—Agar-agar stump model—A—removed from poly methyl methacrylate check socket—B.

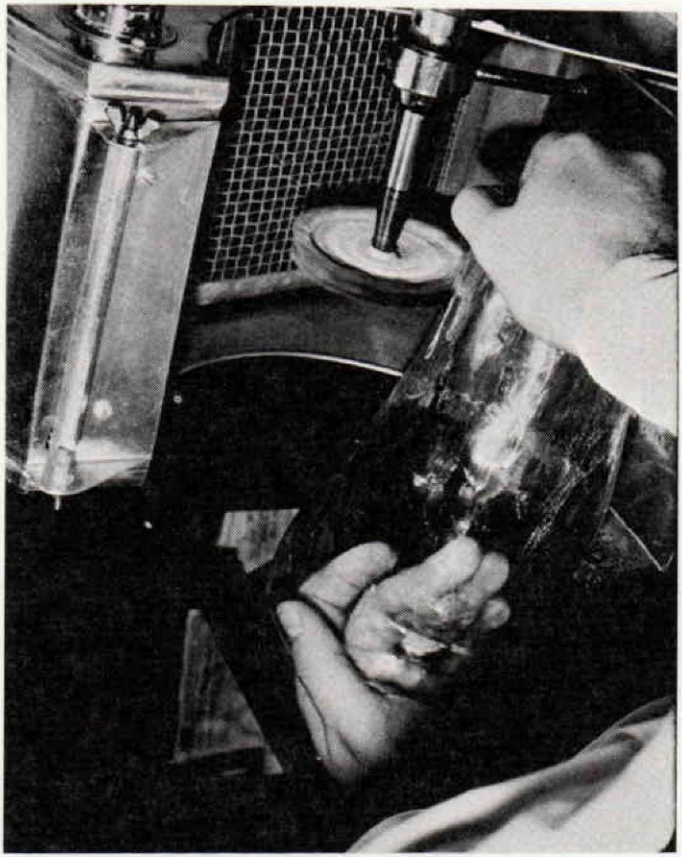


FIGURE 19.—Polishing of poly methyl methacrylate check socket.

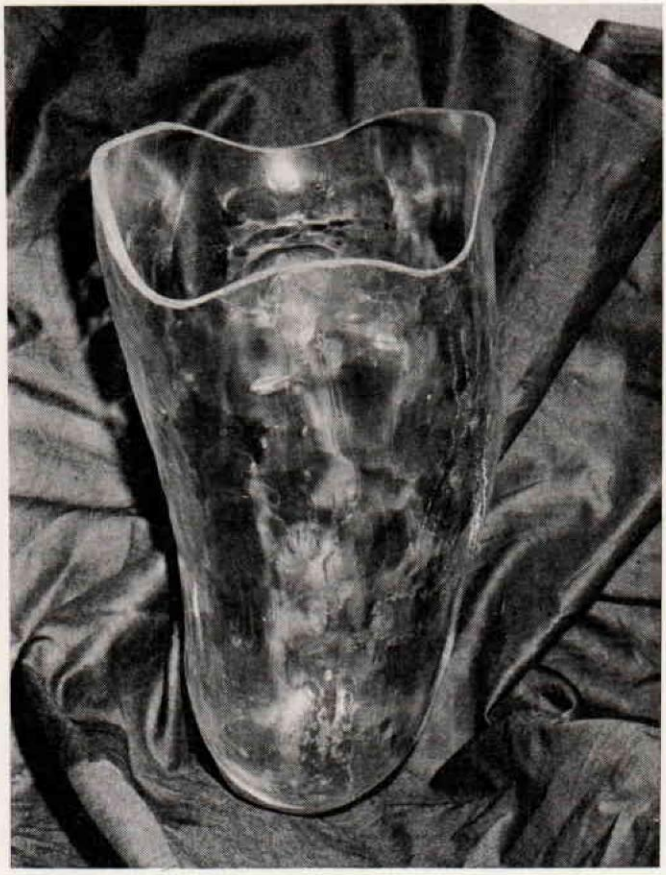


FIGURE 20.—Finished transparent poly methyl methacrylate check socket.

the container (Fig. 17) and the agar-agar is then separated from the check socket (Fig. 18).

The proper relief in the margin of the socket is obtained by cutting the socket with various finishing stones on a lathe. The check socket is polished using a fine pumice and water slurry and a cloth wheel (Fig. 19). A high gloss is obtained by the use of a cloth wheel and polishing compound (Fig. 20).

Discussion

A review of the steps indicates that certain precautions should be taken; these are:

1. The agar-agar duplicating compounds lose moisture and shrink when exposed to air. It is advisable therefore to pour the resin as soon as possible in order to avoid dimensional changes in the finished check socket.

2. Under no circumstances should the agar-agar remain over night. Preferably the resin should be poured within 30 minutes after the gelation occurs.

3. Because heat transfer through the agar is slow the volume used should be kept to a minimum to permit rapid gelation. Gelation may be further hastened by placing the container in cold circulating water during cooling.

In our first attempts vents were placed in several areas around the open end of the socket but it was found that these were not necessary as the fluid resin has excellent flow properties thus eliminating the danger of an imperfect socket. The socket, prepared as described, was fitted to an amputee and pressure points were clearly visible.

SUMMARY

A simple technique for the fabrication of transparent sockets utilizing a fluid bench curing poly (methyl methacrylate) resin has been presented. The finished check socket possesses remarkable clarity and could prove useful in pressure studies on lower extremity amputees.

ACKNOWLEDGEMENT

The authors wish to express their appreciation for the valuable assistance of SFC Jeff D. Duke of the U. S. Army Regional Dental Activity, Walter Reed Army Medical Center, Washington, D. C.

REFERENCE

1. Radcliff, C. W., **Artificial Limbs, 6,** No. 2, June 1962.

Five Years of Non-Operative Treatment of Scoliosis and Kyphosis—A Follow Up Study

by

Siegfried W. Paul, C.P.&O.[1]

The non-operative treatment of scoliosis and kyphosis with the Milwaukee brace can be considered an unprecedented success of an orthotic technique.

We have known of spinal orthoses similar to the Milwaukee brace for a long period of time. However, the introduction of new fitting principles and team approach as advocated by the Doctors Schmidt, Blount, and Moe changed this appliance from a passive apparatus to a functional orthosis.

The basic concepts of the Milwaukee technique have been well desseminated. It is unfortunate that only a few clinics have reported on their experiences with this approach.

Our scoliosis clinic at Newington has seen a rapid growth since it was established five years ago. I would like to discuss our findings of clinical follow-up of 135 patients. We have applied more than 200 Milwaukee braces during the same period. My report is based on records of the scoliosis clinic at the Newington Children's Hos-

[1] Director, Prosthetic and Orthotic Dept. Newington Children's Hospital, Newington, Conn. Based upon a paper presented at the National Conference and Assembly of The Interprovincial Association of Prosthetists and Orthotists of Canada; August 22–24, 1968; Montreal, Canada.

pital and involves only cases treated with the Milwaukee brace.

Of these 135 patients 102 on their first visit were diagnosed as idiopathic scoliosis, 14 as juvenile scoliosis, 4 paralytic, and 15 as kyphosis. Other problems along with scoliosis and kyphosis were noted in 27 cases. They consisted of polio, muscular dystrophy, neurofibromatosis, hemivertebra, amyotonia, spina bifida, syringomyelia, osteogensis imperfecta, arthrogriposis, marphans syndrome and the Kippel Feil syndrome.

The following clinic basic routine was used for the treatment of these patients:

Initial medical work-up, basic evaluation and outline of treat-

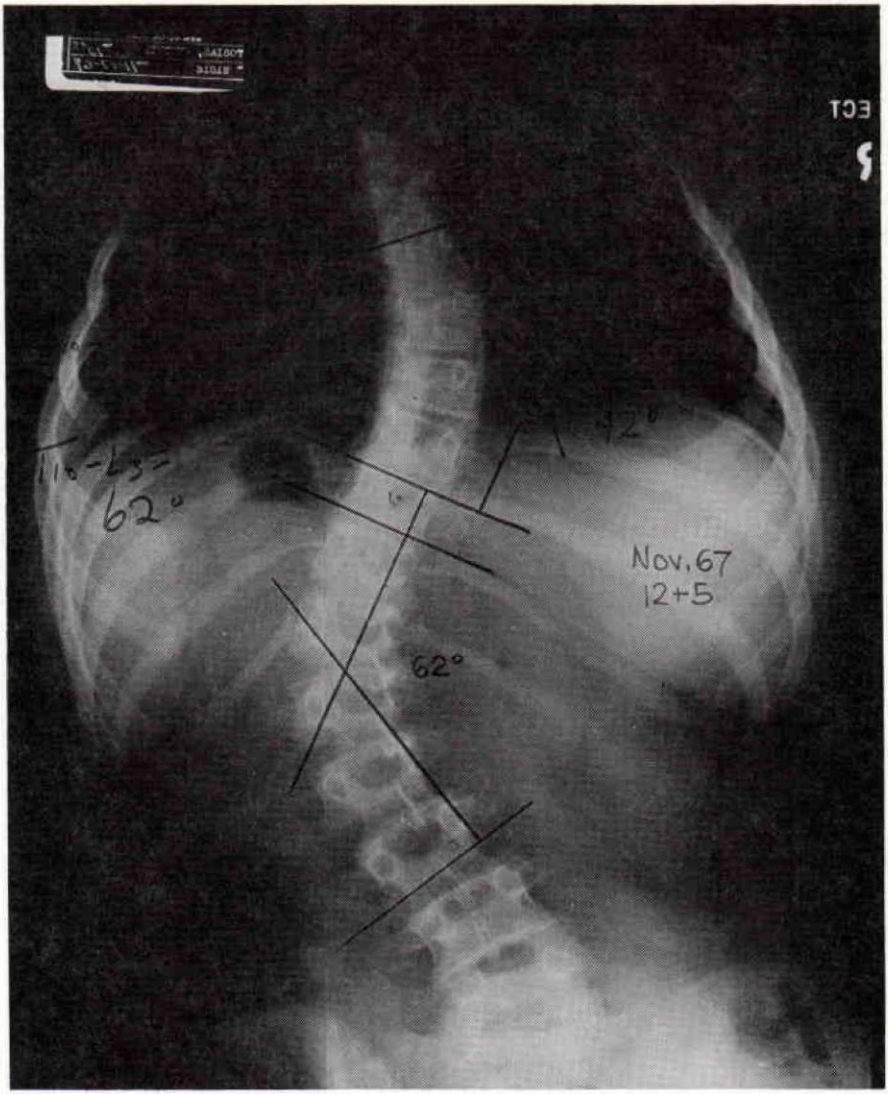


FIGURE 1—X-Ray of patient prior to application of localizer.

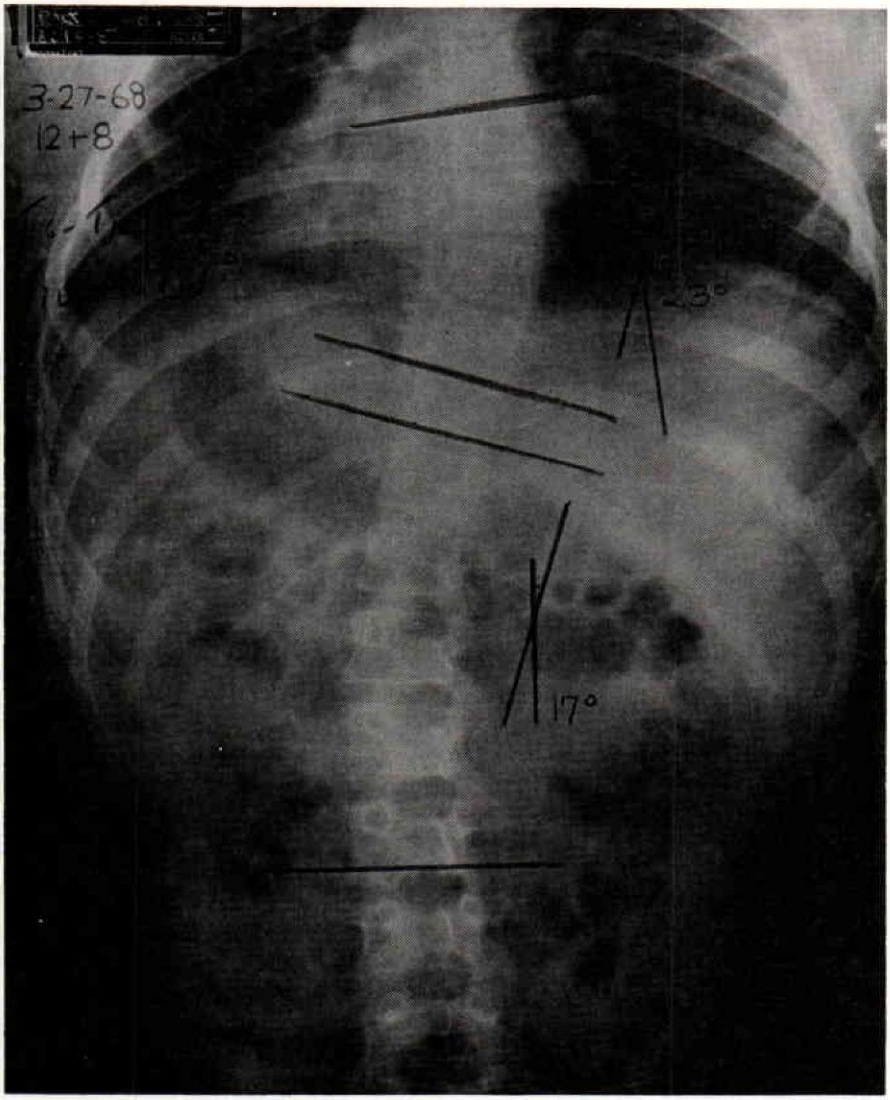


FIGURE 2—The same patient after application of localizer. Note excellent response.

ment, application of a localizer cast for cases with more than 45 degree curvature prior to brace application. A mold for the Milwaukee Brace was made at the same time the localizer was applied, along with impressions for retainers preventing malalignment of the teeth.

Patients wearing a localizer would be re-admitted to the hospital after 4 to 6 weeks for removal of the cast and fitting and application of the brace and orientation of the patient.

X-rays had been taken of the patients after localizer application. New X-rays were made of all patients once the brace had been applied. The patient would receive

wearing instructions, physical therapy instructions and the retainer tested and delivered. The hospitalization which seldom ever exceeded one week, resulted in little or no loss of correction gained in the localizer, excellent brace tolerance and acceptance by the patient. It was also noted that psychological problems occured far less frequently than reported by other clinics.

It is the patients' and parents' cooperation which is needed for a successful course of treatment. The patient returned to the Orthotic Department and the physical therapist one week after leaving the hospital for a review of the exercise routine and adjustments of the brace. It has been our experience, that we were able to achieve considerable correction at this early stage of treatment. The patient returned to the clinic every four to six weeks and would never be allowed to go longer than a maximum of eight to twelve weeks. He would be seen by the orthotist every six weeks for minor adjustments and maintenance of the brace. A localizer (Fig. 1 and 2) was applied or reapplied and the brace refitted if the course of treatment indicated no improvement.

Of the 135 cases studied only ten needed reapplication of a cast. However it should be of interest that (Fig. 3) 48 patients had been localized prior to brace application. It was necessary (Fig. 4) to have a refitting of the brace in 8 cases. Eighteen patients needed new pelvic sections and only 6 patients which had outgrown their

APPLICATION OF LOCALIZER

48 PRIOR TO BRACING

10 REAPPLICATION POST BRACE APPLICATION

FIGURE 3

REFITTING OR REPLACEMENT OF BRACE

8 REFITTING

18 NEW PELVIC SECTION

6 REPLACEMENT OF ENTIRE BRACE

FIGURE 4

brace needed complete replacement during the five-year period.

The present outcome of the 135 patients treated demonstrates the excellent results of the Milwaukee brace treatment: (Fig. 5)

47 patients or 33% corrected to better than 20 degrees.

76 patients, or 56%, improved in the brace or were stabilized.

12 patients, or 11%, had fusions or application of Harrington Instrumentation after use of the brace for a period of time. This compares favorably to a study four years ago when 25% of the brace wearers had to be stabilized through surgery.

It should be of interest also that of the twelve patients who required surgical treatment, two had refused to wear the brace, and two patients had a paralytic scoliosis. Only short fusions with continuance of the brace had been performed in eight cases which had other findings secondary or primary to scoliosis.

The weaning process is the much anticipated moment of the brace patient. This process is carefully guided by our clinic and is pat-

PRESENT OUTCOME of 135 PATIENTS TREATED at NCH with MILWAUKEE BRACE

47 - 33% CORRECTION BETTER THAN 20°

76 - 56% IMPROVED OR STABILIZED

12 - 11% OPERATIVE STABILIZATION

35 IN WEANING PROCESS

28 OUT OF BRACE

FIGURE 5

FIGURE 6—Hinged mandible and occipital section.

terned after the well-known outlines of the Doctors Blount, Schmidt, and Moe. At present we are weaning 35 patients from the brace and follow 28 which have successfully completed their treatment.

Considerable knowledge and experience has been gathered since the clinic was first established. Experiences through solving problems resulted for us in deviations from the orginal approach which should be of particular interest to the orthotist.

Our first (Fig. 6) and oldest modification of the brace was hinging of the mandible section and the posterior uprights (Fig. 7) on their proximal point of attachment.

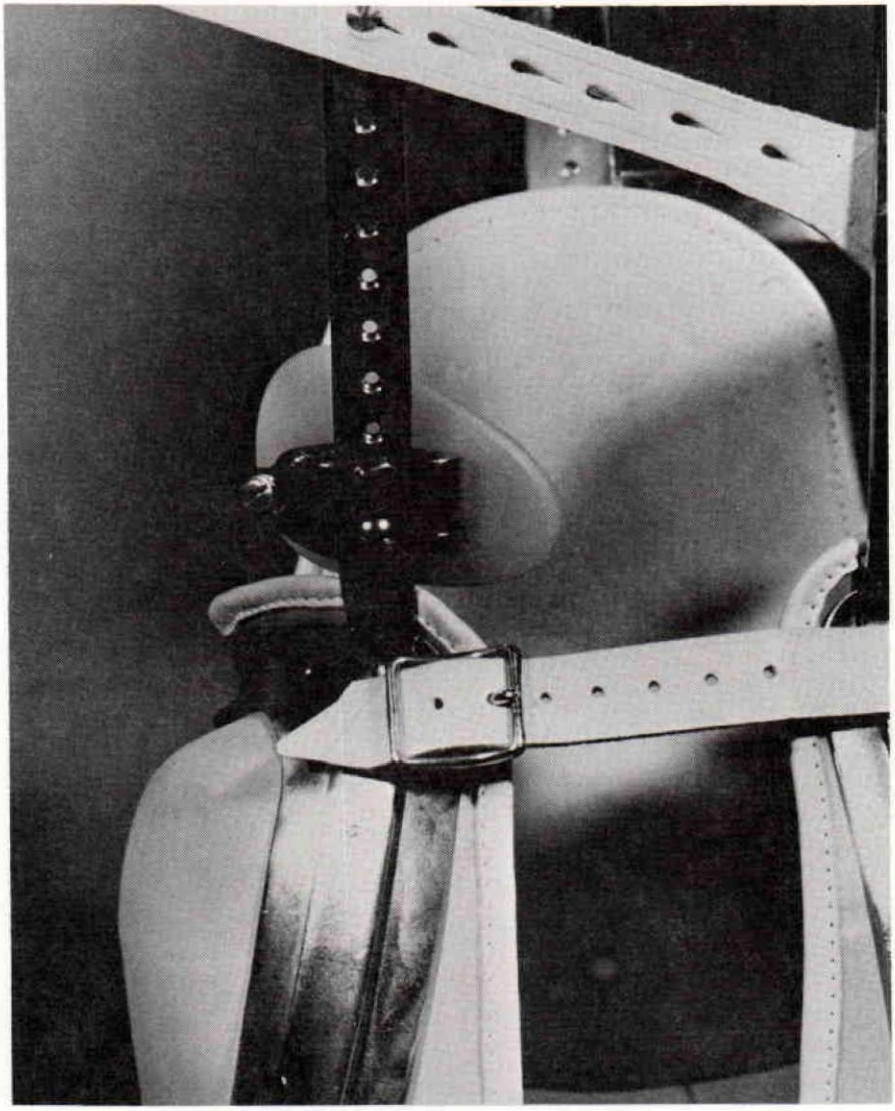


FIGURE 7—Lumbar pad posterior view.

Hinging of the neck ring enabled us to maintain an accurate fit of the entire head section after any adjustment and eliminated undue stresses caused by repeated bending of the uprights.

Major skin problems which occured in particular during the summer were eliminated by treating the entire brace surface exposed to the body with a heavy coating of a non-toxic acrylic. Our patients are now able to clean the entire brace with a damp cloth removing all of the perspiration deposits. It was found that skin reactions from the exposure to copper rivet oxide and the clogging of the pores by perspiration deposits had caused 90% of the

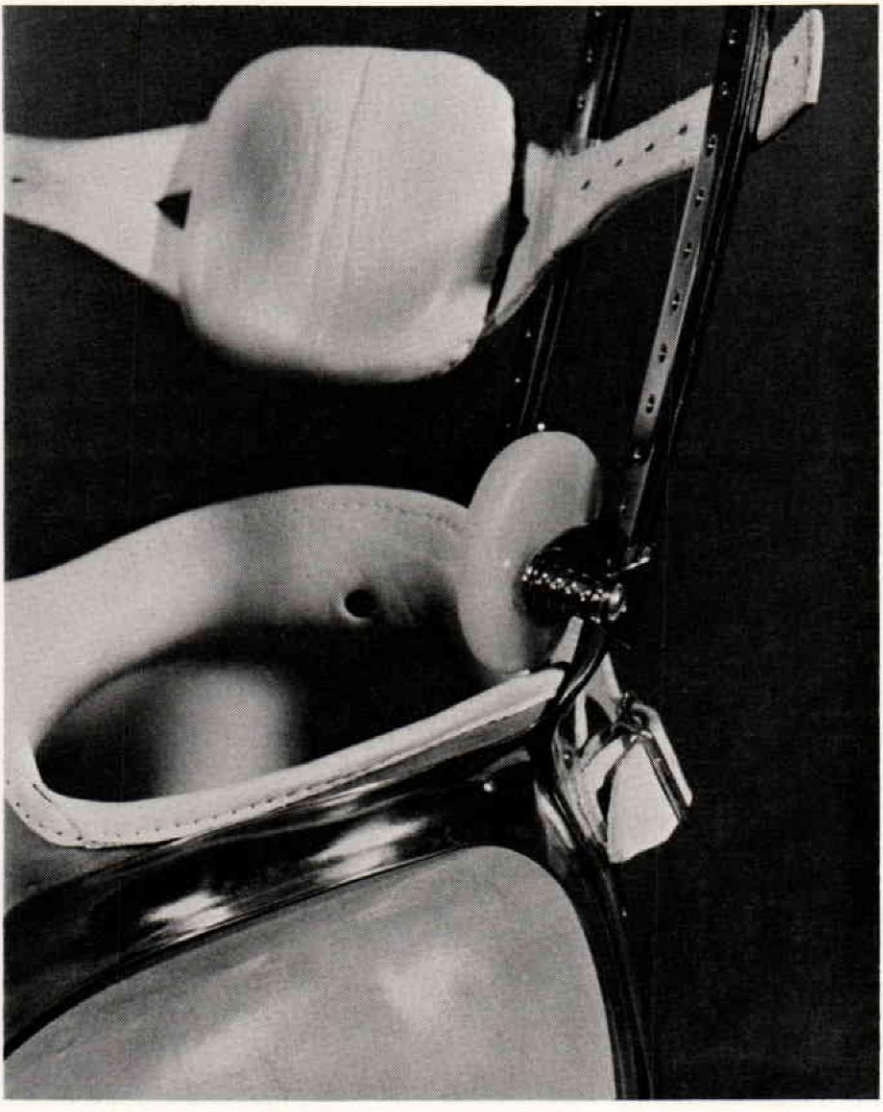


FIGURE 8—Lumbar pad lateral view.

skin irritations. The only breakdown of skin currently observed is the rare occasion of pressure over bony prominences. We definitely prefer to use leather, the organic material, over any other material for the pelvic section.

This does not hold true in the case of a lumbar pad developed by us. (Figs. 8, 9, 10, 11). This spring-loaded hinged lumbar pad is made of Vitrathene, a polythene plastic, imported from England. Utilizing this skin-friendly plastic, which has a soap-like smooth surface for night splints and other orthotic appliances, made us aware of the non-adhering surface of this material. Difficulties were encountered with

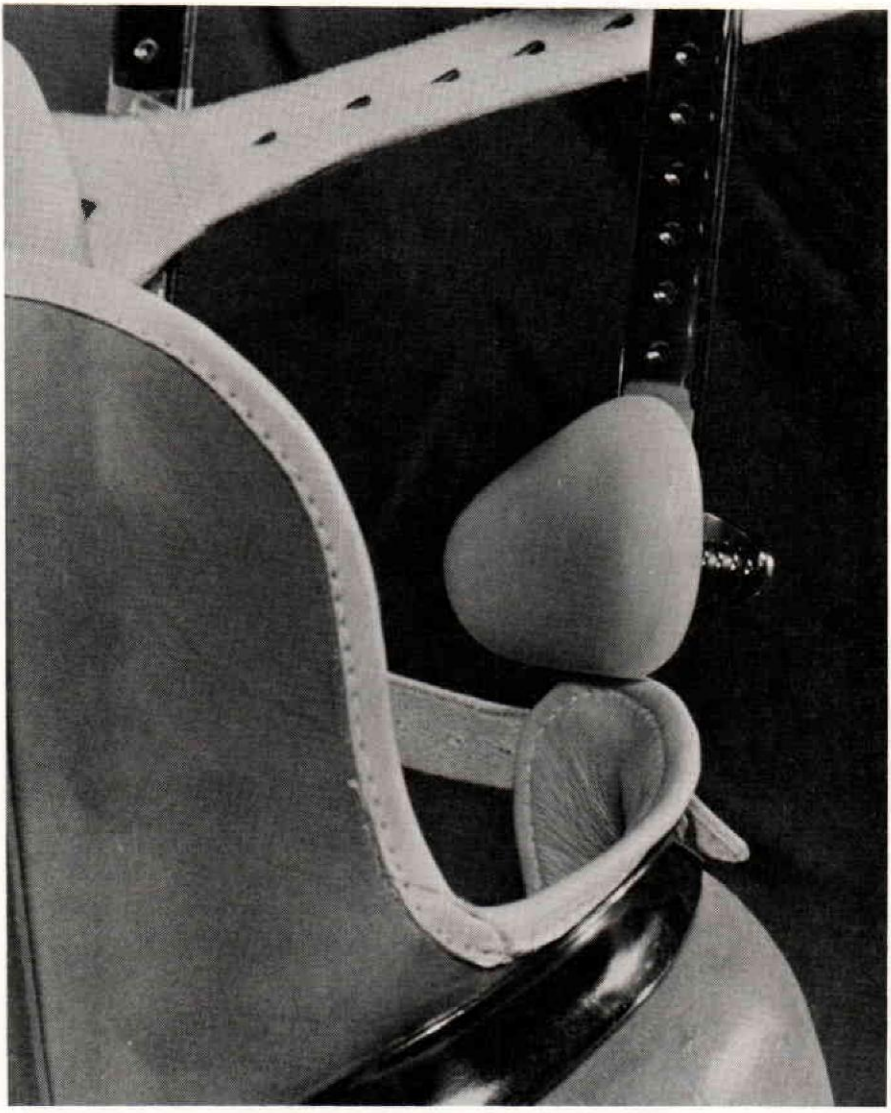


FIGURE 9—Lumbar pad anterior view.

the leather/aluminum combination of the orginal design attached by two straps. One on the anterior surface of the pelvic section looping through the same and the other on the opposing posterior bar. The new pad has been used for two years and many of the good results can be credited to this functional pad. (Fig. 12). The pad is so located that its center is slightly below the apex of the lumbar curve. The center of the pad should be lateral to the transverse processes of the vertebra covered by the pad. The greatest force should be exerted on the lateral portion which should be worn as tight as possible, however, still enabling the

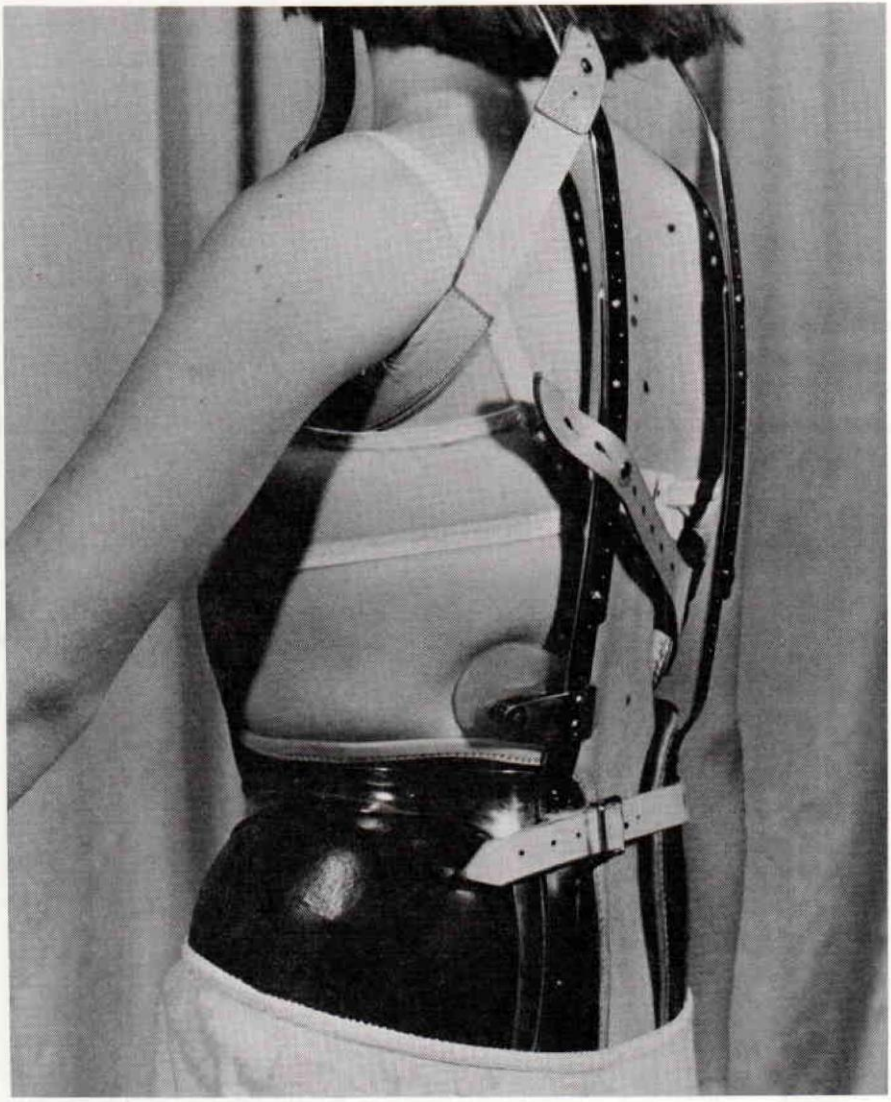


FIGURE 10—Patient wearing lumbar pad and new axilla sling.

patient to pull away from the same.

We know today that the constant contact of the angular hinged and spring-loaded pressure pad has resulted in active lateral correction, derotation and excellent holding support. (Figs. 13, 14, 15). The triangular approach from a properly located thoracic pad, a well fitted functional lumbar pad, and a contoured axilla sling will result in faster and more consistent results in the treatment of the typical scoliosis case.

Our most recent, and by our patients much appreciated, change is a contoured axilla sling. (Fig. 16). The previously worn straight

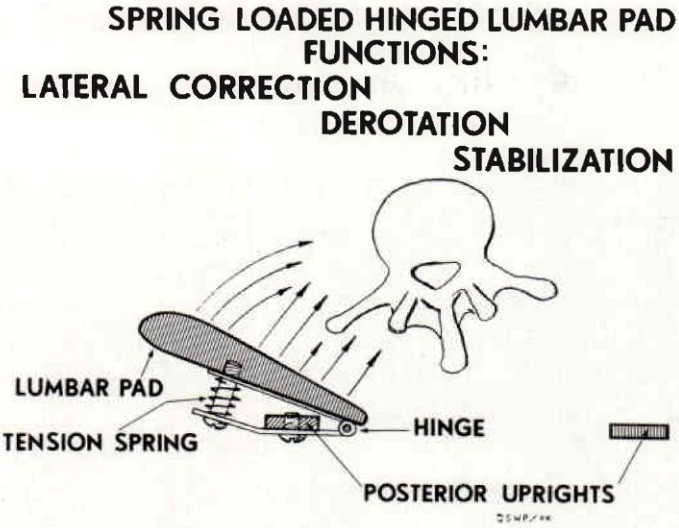


FIGURE 11

padded bar suspended by two straps was bulky and caused, especially in slightly obese cases, general discomfort and pressure on nerves and blood vessels located in the axilla. We borrowed the idea for improvement of the axilla bar from a fitting technique used for the harnessing of more difficult upper-extremity prostheses. The prosthetist is utilizing a "Hessing Axilla Pad" in cases of persistant soreness of the armpit.

The pad as we are using it today is made of well-contoured, padded leather with dacron straps. The pad is so designed that it provides relief for the tendons of pectoralis major and teres major. Its rather flat contour eliminates (Fig. 17) the pressure on nerves or blood vessels. The advantages of this design have enabled us to better balance the force applied through the thoracic pad and resulted in a superior static and dynamic alignment of the brace besides a more comfortable fit.

Orthotists advocating the theory of a rigid bar for the axilla pad can reinforce this contoured pad by riveting a stainless steel plate on the leather surface prior to covering of the pad. It should be noted that the structual more firm and flat surface of the proximal lateral thorax will not lend itself to undesired changes as they could be observed at the lower rib cage level prior to application of a thoracic outrigger.

These modifications along with a follow up pattern of close supervision of the patient and the fit of the brace have enabled us to achieve the desirable end results presented today. The Milwaukee brace properly fitted and applied with good maintenance is without question the most effective conservative type of treatment of scoliosis and kyphosis known to us at this time.

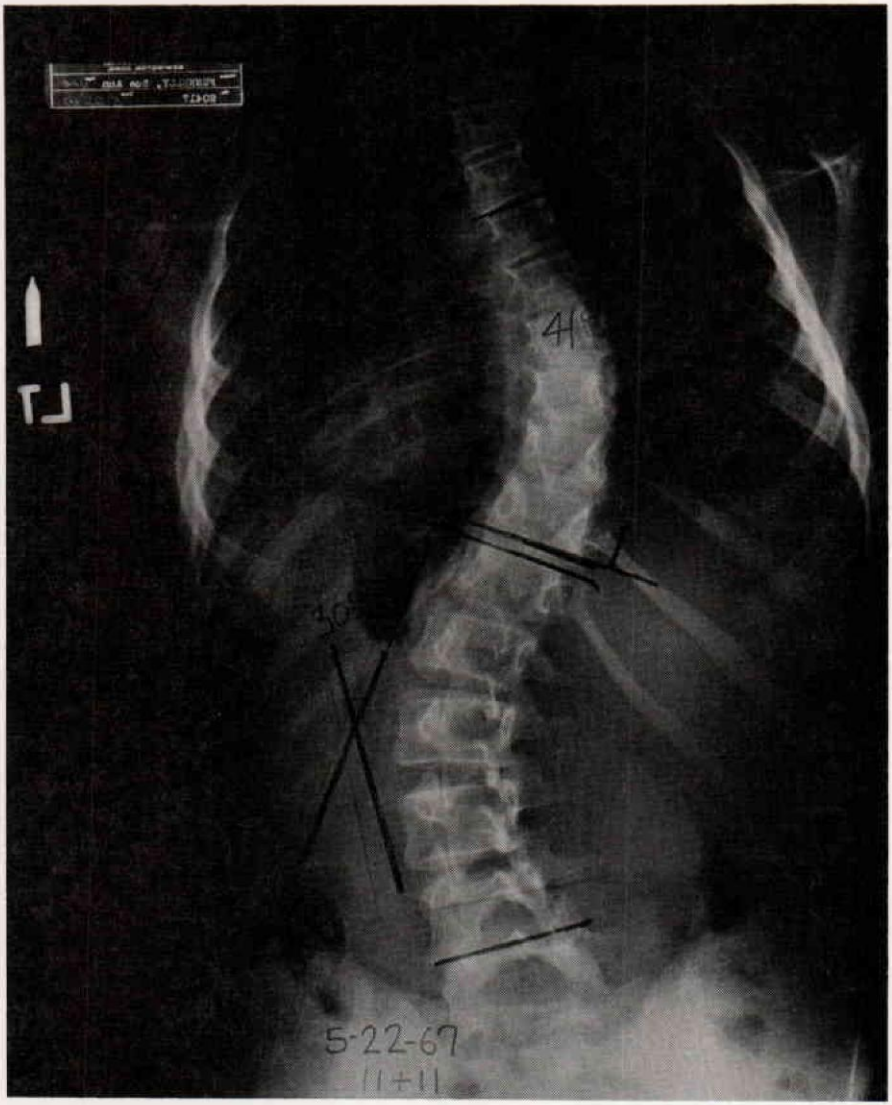


FIGURE 12—Patient prior to brace application. Note lumbar curve 30°, thoracic curve 41°.

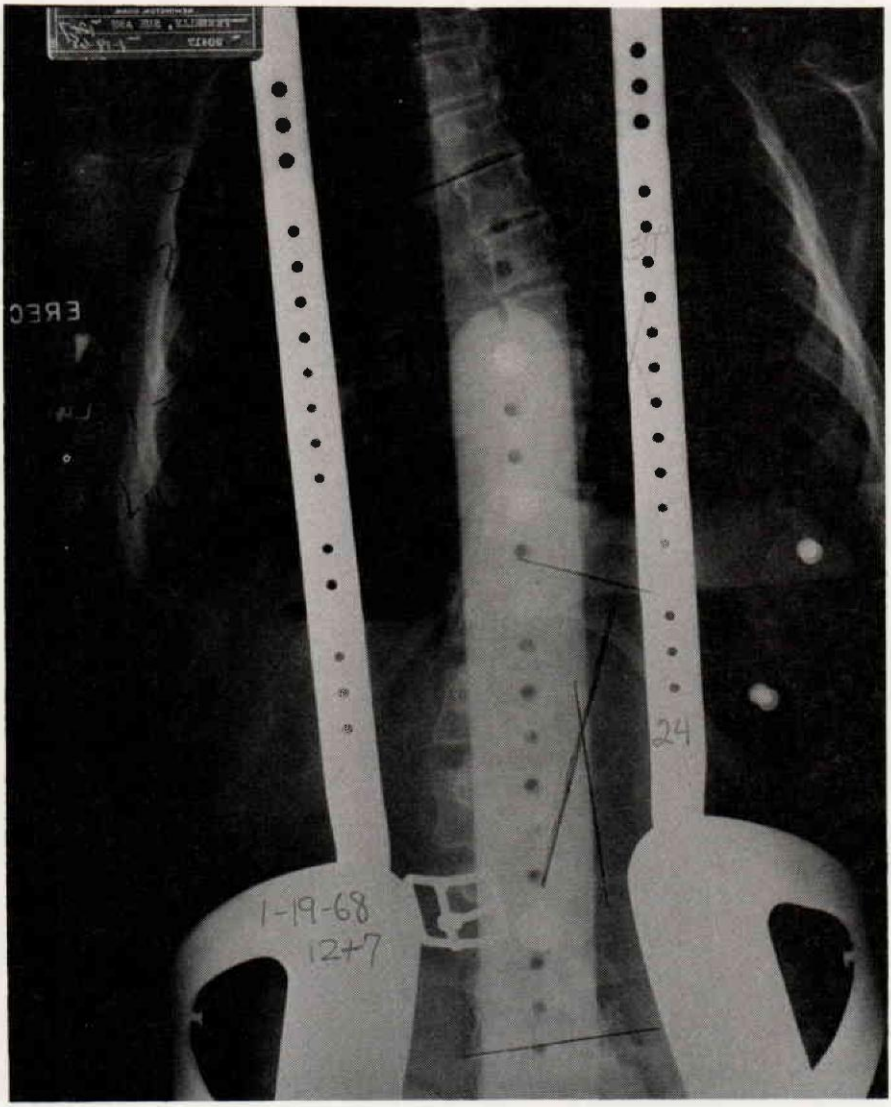


FIGURE 13—The same patient after 6 months in the brace. Note lumbar curve reduced to 24°, thoracic curve to 37°.

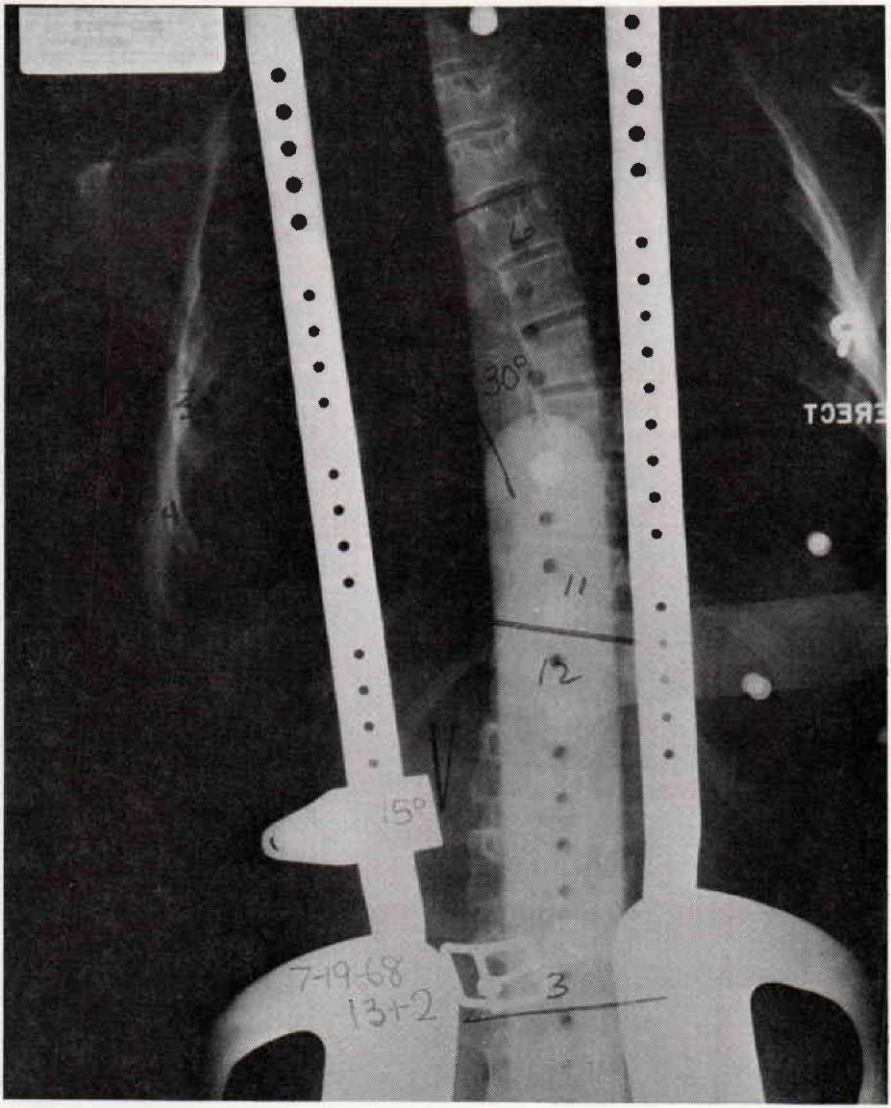


FIGURE 14—Patient after application of lumbar pad, length of wear 4 months. Note lumbar curve now 15°, thoracic curve 30°.

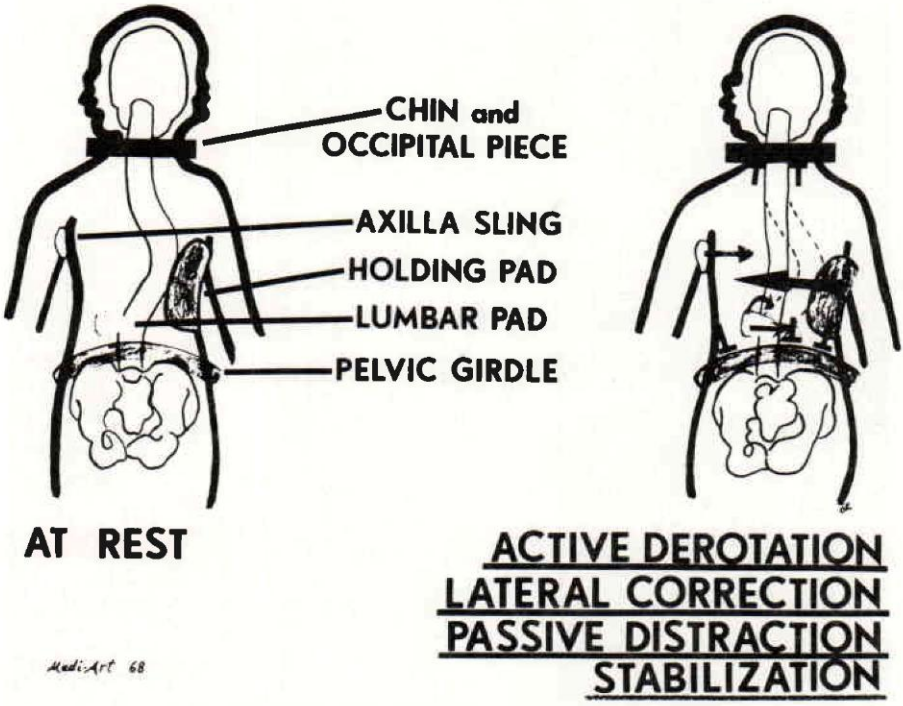


FIGURE 15—Demonstration of bracing principle.

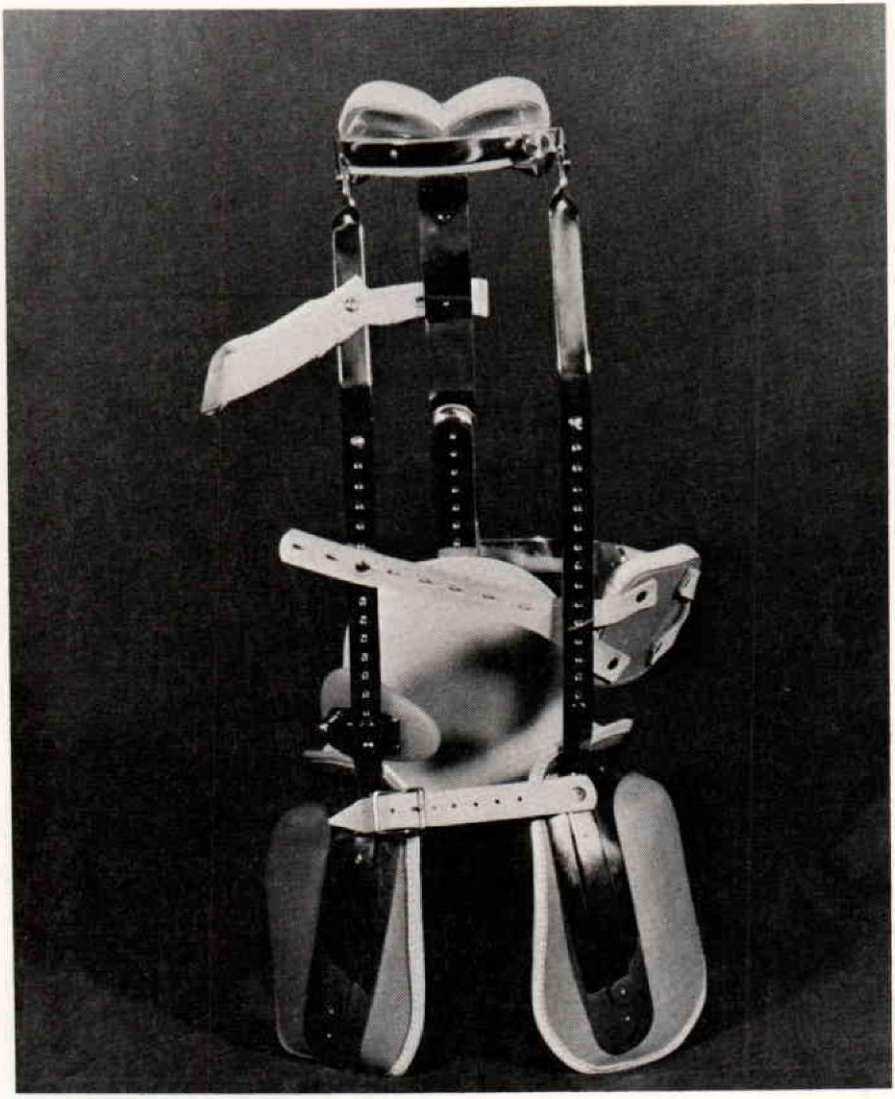


FIGURE 16—Contoured axilla sling, posterior view.

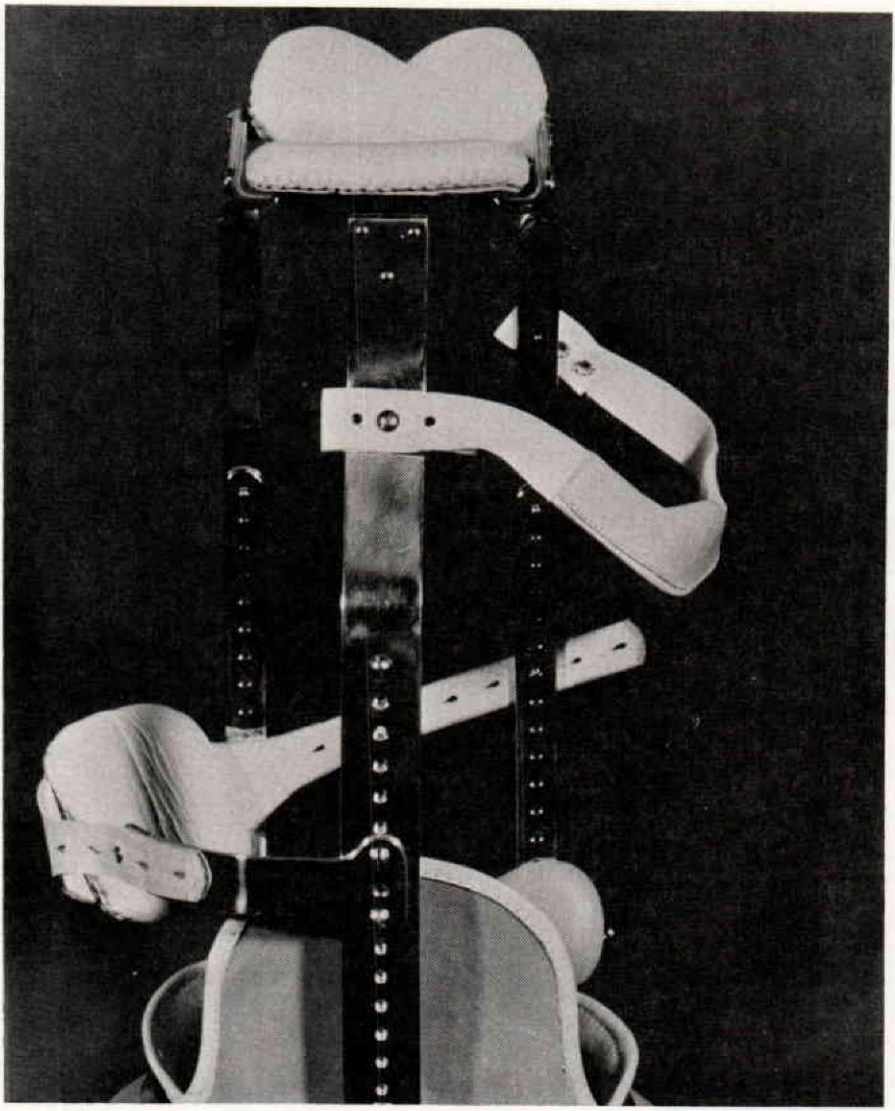


FIGURE 17—Contoured axilla sling, anterior view.

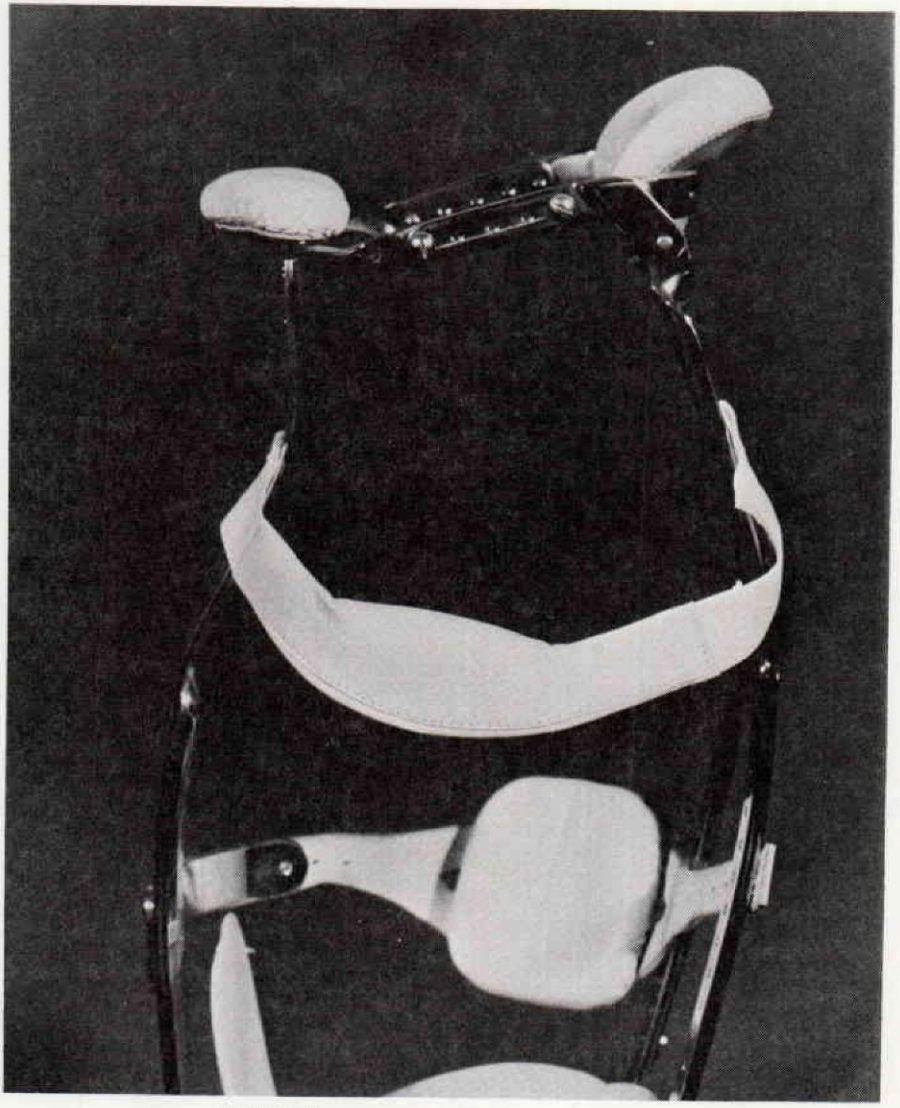


FIGURE 18—Contoured axilla sling, lateral view.

Cosmesis is of greatest importance to our patients and elimination of protruding ribs, winging of the scapula, pelvic tilt and rotation of the shoulder girdle can be considered important results, even though a curvature is present.

Our clinic is presently applying the brace in cases which at one time were considered for surgical treatment only. This type of treatment demonstrates once again the effectiveness of the more and more practiced team effort.

ACKNOWLEDGEMENTS

This paper could not have been presented without the assistance and cooperation of the staff of the Newington Children's Hospital.

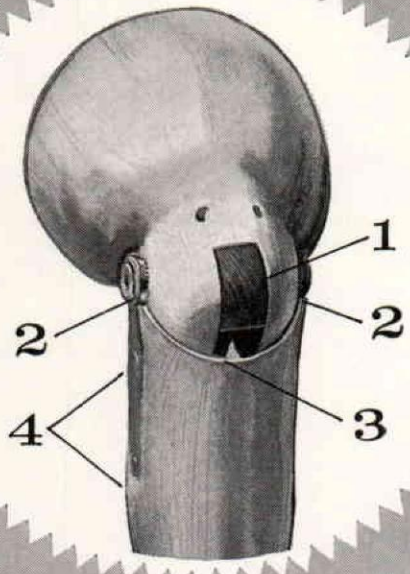
My special appreciation is extended to Dr. Burr H. Curtis, Medical and Executive Director; Dr. James Hardy, Scoliosis Clinic Chief; the members of the Photography Department; Medical Records; the Radiology Department; and the Secretarial Staff of my department.

REFERENCES

1. Albert C. Schmidt M.D. *Fundamental Principles and Treatment of Scoliosis*, **American Academy of Orthopedic Surgeons,** Volume 16, 1959.
2. Walter P. Blount M.D. and John H. Moe M.D. *Non Operative Treatment of Scoliosis with the Milwaukee Brace.* **Instructional Pamphlet.**
3. John H. Moe M.D. Division of Orthopedic Surgery, University of Minnesota Med. School, *The Milwaukee Brace*, **Technical Manual.**
4. William R. Santchi. Dept. of Engineering U.C.L.A., *Manual of Upper Extremity Prosthesis.*
5. John T. Scales M.R.C.S. and L.R. C.P. Reprint from *Modern Trends in Surgical Materials* for Stanley Smith and Company, Isleworth, Middlesex, England.

4 NEW IMPROVEMENTS in the U.S. Mfg. (2L-105) Conventional A/K Knee Shin

For many years, it has been the policy of U.S. Mfg. Co. to continually improve the design and quality of their products. Four examples are listed below.



1

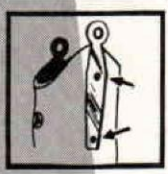
Hard wood insert in knee prevents compression of wood on impact of stop.

2

Aluminum bushings set in knee with epoxy eliminates oil from oil-lite bearing penetrating wood.

3

New light weight precision die cast back stop.



4

Side straps machine riveted into shin.

..... Sold on prescription

Knee Width	Calf Circumference
3"	11½"
3¼"	12"
3½"	13¼"
3¾"	14¼"
4"	14⅞"
4" (Extra Large)	16½"

QUALITY USMC

UNITED STATES MANUFACTURING CO.

P.O. Box 110, 623 South Central Avenue, Glendale, California 91209, U.S.A.

Prescribed most frequently

MYO COLLAR one piece unit with overlapping upper and lower parts, for varying degrees of extension. (Four sizes)

MYO-VENT COLLAR stable one-piece split extension collar, ventilated, adjustable. (Five sizes)

CERVENT COLLARS available in extension & flexion models, for use where prolonged extension or flexion is indicated. (Four sizes)

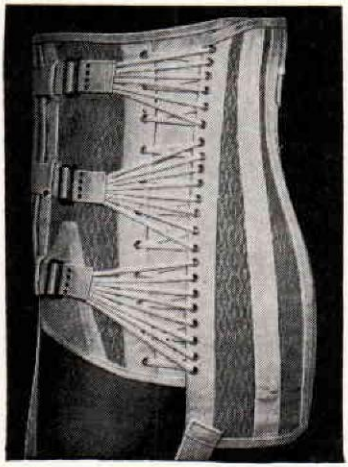
EXTENSION & FLEXION COLLARS combinations from only three sizes each, of adjustable and non-adjustable units give practically all sizes and degrees of extension or flexion.

A wide variety of models assure adequate immobilization and support of neck and head in optimum position. Lightweight, ventilated, inert polyethelene body. Closed cell expanded neoprene padding. Contact surfaces vinyl-coated knit fabric resistant to body secretions and non-allergenic to practically all patients. Snap fasteners or Velcro. For illustrated catalog, write Florida Brace Corporation, P. O. Box 1299, Winter Park, Fla. 32789.

FLORIDA BRACE CORPORATION

DEMAND THE FINEST FOR YOUR CUSTOMERS

KENDRICK'S sacro-lumbar supports of dacron mesh



No. 8458-S Kendrick Sacro-lumbar Supporter with Dacron Mesh. Available in sizes 32 to 44 (hip measure).

PRESCRIBED BY PHYSICIANS...SOLD WITH CONFIDENCE

For your customers, there should be no substitute for the finest. Kendrick's Sacro-lumbar Supports of Dacron, an amazing synthetic fabric, provide the most reliable and comfortable support possible. The porous weave of Dacron is ideal for summer wear — lets the skin breathe — or all-the-year around.

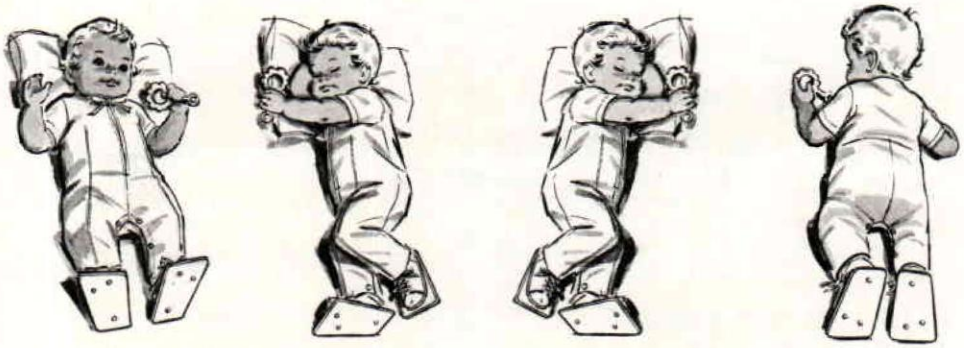
Kendrick's Dacron Sacro-lumbar Supports are lighter and far more comfortable — their durable, porous construction gives safe, long-lasting support to the wearer. Lumbar stays are removable so the supports are easy to wash, quick to dry. Styles for male or female.

Specify surgically correct Kendrick products for your customers. Their confidence in you will result in more frequent repeat sales and higher profits.

You can recommend Kendrick with Confidence

JAMES R. KENDRICK COMPANY, INC.
Philadelphia, Pa. 19144 New York, N. Y. 10016

Kendrick
SINCE 1853



The angles of the plate maintain same leg rotation whether the child sleeps on its back, either side or prone.

Another new angle in the combined treatment of mild foot, leg and/or hip abnormalities.

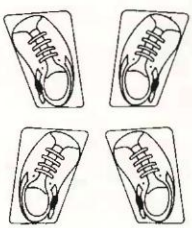
Now, in addition to our Roto-Sleeper Surgical shoe, Sabel introduces a pre-walker outflare shoe, attached to an extended plate with the angles of a tetragon to be used in mild cases of abnormalities.

Now, the physician can take action in doubtful cases instead of "wait and see."

Sizes Narrow 000 to 4, full sizes only
Order from your Sabel franchised dealer.

EXTERNAL ROTATION

INTERNAL ROTATION



MATLES ROTO SLEEPER

SABEL'S

I. SABEL SHOES, 1207 CHESTNUT ST., PHILA., PA. 19107
SABEL DIVISION, R. J. POTVIN SHOE CO., BROCKTON, MASS. 02402

LIMB PROSTHETICS—1967

by A. BENNETT WILSON, JR. B.S.M.E.

REPRINTS OF THE ABOVE ARTICLE WHICH APPEARED IN THE SPRING, 1967 ISSUE OF *ARTIFICIAL LIMBS* ARE NOW AVAILABLE THROUGH THE NATIONAL OFFICE.

TO OBTAIN REPRINTS, COMPLETE AND MAIL THE FOLLOWING FORM.

AOPA
919 18th St. N.W.
Washington, D.C.

Please forward_____copies of "Limb Prosthetics — 1967" @ .35 per copy to:

name _____

address _____

_____

☐ Check enclosed ☐ Bill me

Journal Gift Subscriptions

Although it has traditionally been possible to obtain gift subscriptions to the AOPA Journal, an innovation has been introduced this year. A gift certificate (shown below) is being sent to the recipient of the gift subscription in the name of the donor.

To order gift subscriptions, send a list of the names and addresses of those to whom you wish the Journal sent, and the National Office will do the rest.

$4.50 per year is the gift rate.

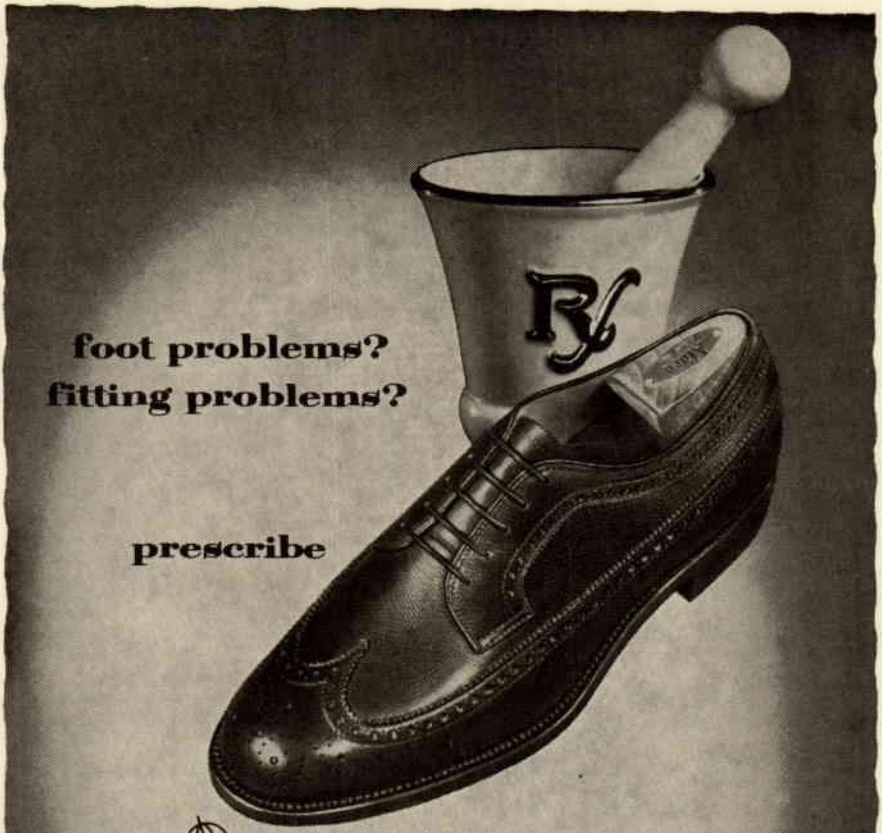
GIFT CERTIFICATE

A gift subscription to *Orthotics and Prosthetics,* the official Journal of the American Orthotic & Prosthetic Association, has been entered in your name by

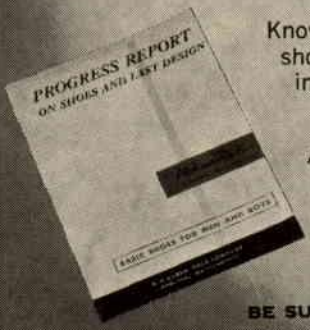
The J. M. Lowd Company

We are happy to include you among our many readers and know that you will find the Journal interesting and informative.

The Editor



ALDEN PEDICS®...THE ONLY SHOES WITH LASTS FOR EVERY FOOT TYPE



Know that your corrections will be made best in shoes uniquely designed to accommodate them . . . in a stable, controlled, superior quality foundation.

Alden-Pedic's superior accommodation of prescribed corrections is achieved not only with unique last selection. Long inside counters; right and left ortho heels, long inside; heavy gauge right and left ribbed steel shanks; and premium leathers combine to provide the finest foundation made for your corrections.

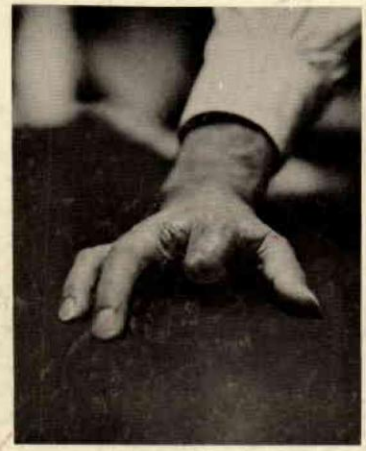
BE SURE. WRITE FOR YOUR FREE PROGRESS REPORT ON SHOE & LAST DESIGN & ILLUSTRATED BROCHURE

C. H. ALDEN SHOE COMPANY • BROCKTON, MASS.

"PLASTISKIN" Perfection

"Color stability is good, permanence is satisfactory—resistance to soiling is substantially superior—are much easier to keep clean."

"Human Limbs & Their Substitutes," sponsored by Committee on Artificial Limbs, National Research Council.



Tenenbaum, Prosthetics

463-469 East 142nd Street, Bronx, N. Y. 10454