TRENDS IN NONLICENSED MOBILITY AIDS

Ronald Lipskin, M.S.
Staff Engineer, Bioengineering Research Service
Veterans Administration Prosthetics Center
252 Seventh Avenue, New York, N.Y. 10001

The scope of nonlicensed vehicles includes electrically powered wheelchairs, golf-cart-type vehicles, a variety of multifunctional devices, and some gasoline-engine-powered vehicles. Until several years ago, the standard nonlicensed powered vehicle was the Everest & Jennings "34" Power Drive Wheelchair (Fig. 1). This unit has been directed to institutions and general indoor environments where it has enjoyed considerable success. Several offshoots of the basic Power Drive include the Motorette, the Rolls Electric Wheelchair, and the Everest & Jennings "33" Power Drive. All of these powered wheelchairs, including the "34" Power Drive, are normally operated by hand-manipulated joy sticks. The Everest & Jennings "34" Power Drive and the Rolls Electric Wheelchair are essentially equivalent in performance. The former incorporates a belt drive while the latter uses a direct friction drive. The Motorette (Fig. 2) is rather novel in that it is an "add-on" assembly, capable of converting virtually any conventional wheelchair into a powered unit. Both the Motorette and the Everest & Jennings "33" Power Drive incorporate proportional control joy sticks, exemplary of an introduction of electronics into physical rehabilitation. The more severe spinal-cord-injured quadriplegic and similarly paralyzed individual are generally unable to use manual joy-stick controls. Several years ago, Everest & Jennings introduced a chin-controlled joy stick (Fig. 3). The aerospace industry generated considerable initial excitement with the Sight Switch (Fig. 4), that depended upon movement of both eye balls to effect wheelchair control via special optical switches. Breath controls have appeared in some clinics and other techniques are being investigated.

It is interesting to note that the two common types of wheelchair drives, including belt and direct friction drives, have both been under attack from time to time for a variety of reasons. For instance, the direct friction drive generally exhibits excessive tire wear while the belt drive usually requires frequent adjustment and is difficult to push when
malfunction occurs. In view of these and other apparent problems, an effort has been underway to develop a "powered wheel," a device that incorporates one or more motors within a special wheel assembly (Fig. 5). Such a unit is now available in the United Kingdom through Dudley Controls, Limited. Here in the United States, Gar Wood Enterprises, of Miami, Florida, is developing a similar system.

For many years, a demand has existed for the development of a truly portable, foldable, electrically powered wheelchair. The conventional powered wheelchairs are neither portable nor foldable, in a practical
sense, since the wheelchair user is unable to independently handle the one (or two) battery(s), which serves as power source, or the wheelchair, which generally incorporates a heavy duty construction and the burden of additional weight of both motors. Usually, more than one person is required to disassemble the chair and to put it into an automobile trunk for transportation. Consequently, we have seen one or two attempts for the development of a small power unit. A response to this demand, is the A-BEC Electric Wheelchair (Fig. 6), available from the United Kingdom. It is apparent that while the unit offers lightweight construction, it fails to match the characteristics of a conventional wheelchair configuration and structure for many wheelchair users. Also, it should be noted that the reduced battery and motor size necessarily result in reduced performance which seems contrary to the needs of many of today's veterans.

Many VA patients refuse to be confined to the immediate physical environment of the home or hospital. The younger spinal-cord-injury-type patient is frequently motivated to achieve a relatively high level of independence. Many of these individuals have returned to school in order to improve their economic and social potential. Consequently, on the university campus and in typical nonurban areas, these individuals
FIGURE 3.—Everest & Jennings Chin Control for electric wheelchairs.

FIGURE 4.—Sight Switch.
must negotiate grassy and rough terrain as well as steep inclines. Even in urban areas, speed may be a critical factor, especially for those patients entering into traffic and crossing at busy intersections. It is not surprising, therefore, to see the emergence of more powerful electric wheelchairs such as Motorette’s 24 volts power pack and Everest & Jennings experimental 24 volts system. Both powered chairs are able to attain speeds in excess of 5 m.p.h. Typical, conventional electric wheelchairs are generally able to attain speeds of up to 3 m.p.h. We, therefore, observe that the restraining environment of the hospital, institution, and
home has partially retreated for many paralyzed veterans. The conventional electrically powered wheelchair is undergoing a metamorphosis into a higher performing nonlicensed vehicle, and a trend toward increasing performance is most apparent.

While the higher performing Everest & Jennings and Motorette 24 volts units superficially resemble their 12 volt counterparts, the Advanced Wheel Chair (Fig. 7) is substantially different in appearance although it provides many standard and desirable conventional wheelchair characteristics such as adjustable back, adjustable height armrests,
and adjustable foot rests. The Advanced Wheel Chair exhibits a superior structural distinction to accommodate the additional weight of motors, batteries, as well as significantly increased mobility stresses.

Recently, the golf-cart-type vehicle has emerged as the vehicle to provide increased performance. There is a potential problem that these mobility aids may require some sort of licensing by local traffic departments. Typical of the class of vehicles is the Everest & Jennings Mark 20 Power Cart (Fig. 8), Steven Motor Chair, and Zip Car, all especially suited for outdoor use. The interest for an ever higher performing
family of vehicles is being met by the application of gasoline-powered engines. This approach is illustrated by a powered front wheel such as that used in the Chair-E-Yacht (Fig. 9) and Para-Cycle (Fig. 10). The former vehicle consists of the powered front wheel followed by a platform and two rear supporting wheels. Upon the platform is positioned the wheelchair and its occupant. The driver may enter onto the platform by means of a small ramp which is readily raised by pushing a side lever. However, no tie-down system is available as yet and instability is an ever present danger. The latter mobility aid makes use of a powered wheel that attaches to both armrests of a conventional wheelchair. The powered wheel is then able to pull the wheelchair and its occupant at speeds in excess of 10 m.p.h. It is questionable whether or not the conventional wheelchair is able to sustain the severe stresses of highly increased mobility performance. It must be pointed out that these gasoline-powered vehicles are limited to outdoor use and may be subjected to state licensing regulations.
The Humanics Rehab-Chair (Fig. 11) is a powered vehicle that provides multifunction capability and permits its occupant to change his position and attitude. Multifunction, conventional, manually operated wheelchairs, such as the Overly-Bressler Stand-Up Wheelchair (Fig. 12), are appearing. While neither of these multifunction mobility aids is a final solution to the many needs of paralyzed wheelchair users, they are both illustrative of the variety of new types of nonlicensed mobility aids becoming available.

The trends in nonlicensed mobility aids are definitely dynamic in nature, and it is apparent that increased performance has become a recent but common need. The demand is obviously attempting to fill a void between the conventional electrically powered wheelchair and conventional licensed vehicles. However, to date, none of these systems has clearly filled this gap with respect to need, safety, practicality, and reliability. One may also question whether this desire to fill the void is worth the effort. Nevertheless, the trend, at this time, is clear.
FIGURE 10.—Para-Cycle.
Figure 11.—Humanics Rehab-Chair.
FIGURE 12.—Overly-Bressler Stand-Up Wheelchair.