

Wheelchair Acceleration Limiter

by

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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.

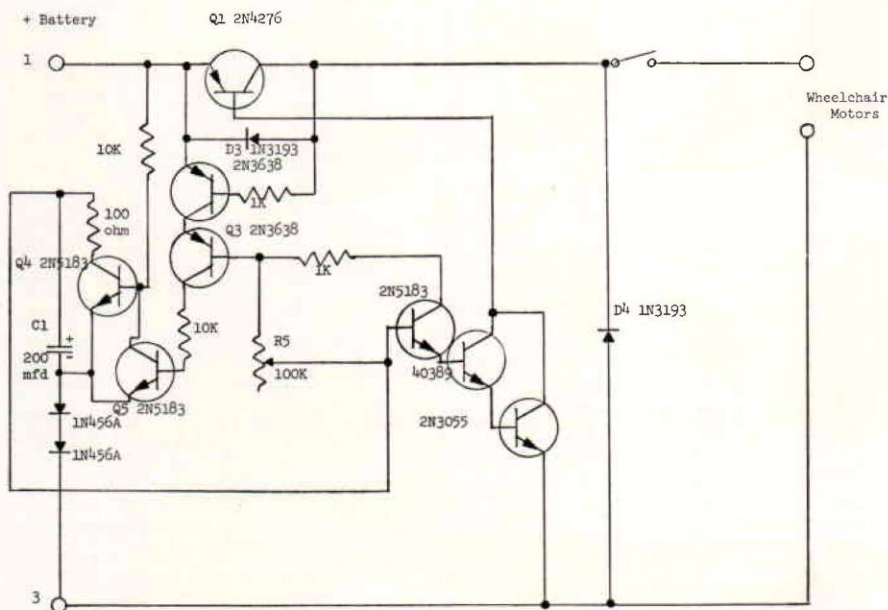
Results have been gratifying, and we plan to make these devices available to all future electric wheelchair patients who are admitted to our Physical Medi-

cine & Rehabilitation Department.

Current from the wheelchair batteries is supplied to the motors through a silicon power transistor 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

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ACCELERATION 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

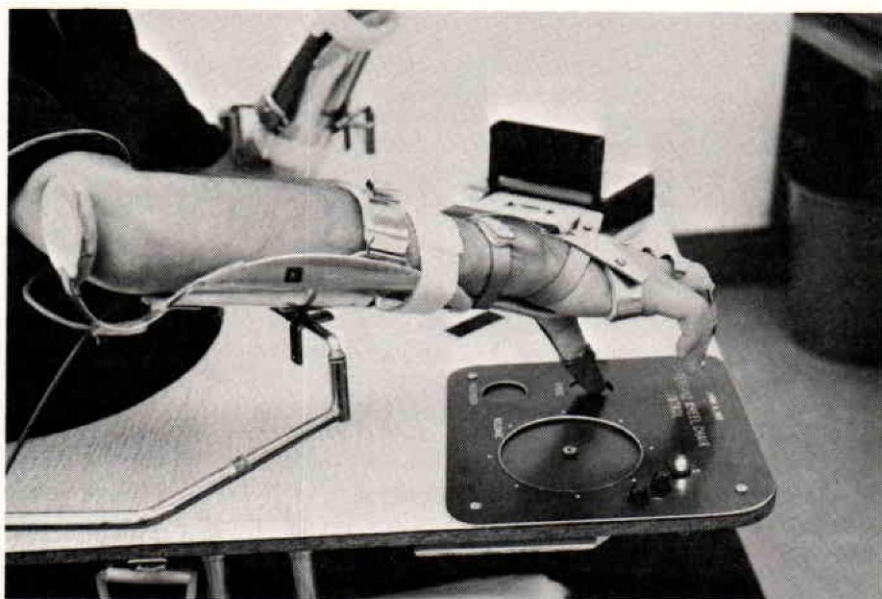


FIGURE 3

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" \times 4" \times 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.