An interesting type of motor is the polyphase squirrel cage induction motor, oil cooled and driven with a continuously variable frequency converter. This "in the wheel" motor is presently used in the integral motor wheel drive of an experimental army truck and off-road heavy vehicles.[3] These automotive electric-traction motors weigh about 2 pounds per horsepower and it is claimed that they can be designed as low as 1 pound per horsepower. Automotive motor requirements are less stringent than those usually employed for designing stationary electric motors. For example:

Full-power demands are intermittent and occur only during one-fourth to one-half of the running time.

The motor lifetime design need not be over 10^5 hours of operation.

The automotive industry has many incentives to lighten the weigh of motors by increased use of nonferrous alloys.

Forced cooling with water or oil is desirable and acceptable.

The power delivery of these future automotive-traction motors then is about

$$HP=0.5w \quad . \; . \; . \; . \qquad (2)$$

where w (pound), is the weight of the motor and of the frequency converter. Combining expression (1) with (2), (that is, matching the initial zero- to 30-mile-per-hour performance of modern gasoline engines) gives for the electric motor weight $w=0.04W$.

With X in table 2 being w/W, and equaling 0.04, Y is equal to 0.49. In other words, about 4 percent of the weight of electric cars should be assigned to traction motors and almost half the weight to batteries.

It is interesting to note here that the torque performance of the electric motors (when driven at constant power beyond 15 miles per hour), parallels quite satisfactorily the wheel-axle, torque versus speed curves of conventional internal combustion engine automobiles up to moderate highway speeds. (See fig. 5.) This eliminates the problem of driver readaptation to electric propulsion in city and suburban traffic. The characteristics of the motor in reference 3 seem to assure that the electric car responds and performs as a piston engine-powered car would to the driver's acceleration pedal demands under the most frequent stop-and-go traffic conditions. In figure 5 the automatic transmission curve (dashed) is a composite of the manufacturers' data on the latest model cars, whereas the low-slip electric induction motor curve is based on assumed operation at constant wattage after 15 miles per hour.

The maximum speed of electric automobiles on a level road can be calculated by equating the constant propulsive power delivered by the motor with the power required to overcome aerodynamic drag, tire-rolling resistance, and any other frictional dissipative forces (the last being negligibly small compared to aerodynamic and tire resistance).

[3] "Powered Wheels," Product Engineering, vol. 37, No. 5, Feb. 28, 1966, p. 58.