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Re-inventing the Wheel

Square Wheel Car That Propels Itself by Shifting Weight

(Patent Pending)

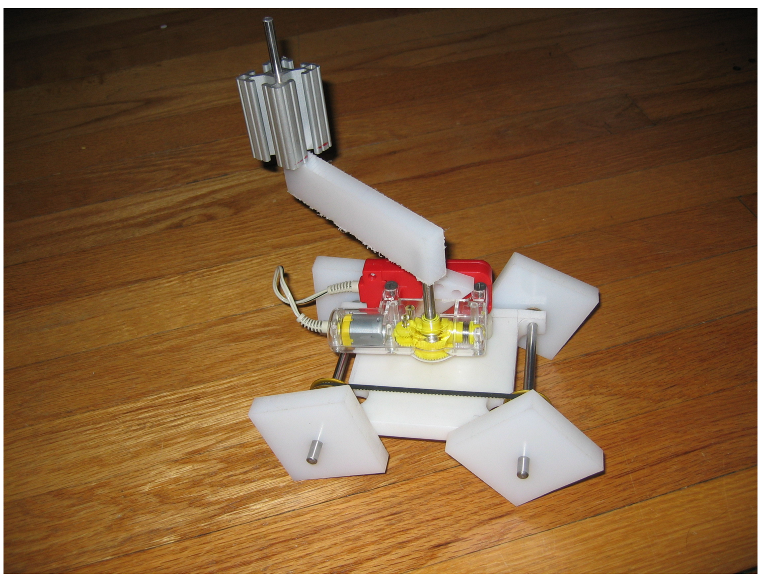
While the title suggests a very narrow topic, there are in fact many interesting variations that arose during research on this device. The application of which include robots, micro machines, novelty toys, and others.

The first prototype consisted of a car with 4 square wheels, in the general configuration of a typical car, with all 4 wheels mechanically connected together so they must all turn in unison. Furthermore, the rotational orientation of the wheels are sequentially off-set from one wheel to the next by 22.5° (¼ of 90°), moving around the vehicle in a CW or CCW direction as viewed from above.

The weight shifting that propels the car is facilitated by a weight offset laterally from the center of the car that is moved in a rotational manner around the center of the car. The rotation is provided by a driven shaft extending vertically from the center of the car, with a lateral arm and off-set weight. As the shaft rotates, the weigh shifts in a circular manner around the car.

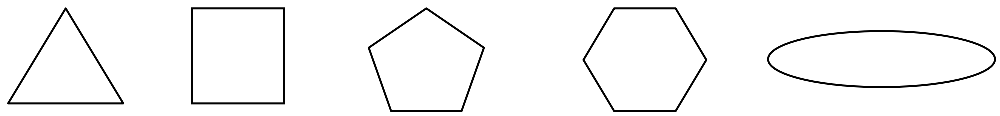
The shifting weight sequentially drives each wheel that is under the weight to sit flat on the ground, thus moving the other wheels in a rotational manner, and the car in a linear direction; reversing the direction of the rotating weight, reverses the direction of the car.

First Prototype

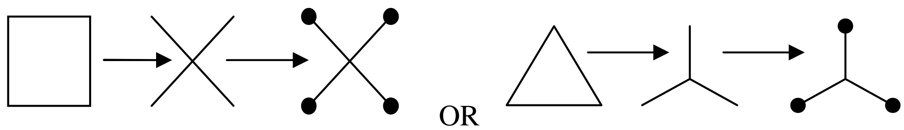


A three wheel version is also possible, and the wheels would be 30° out of phase, replacing the 22.5° for the four wheel version. Versions with more than 4 wheels are also possible, and might be advantageous in smoothing the motion of the vehicle.

Other potential wheel shapes include regular polygons (equilateral triangle, square, regular pentagon, regular hexagon, regular heptagon, and so on), non-regular polygons (e.g. rectangles), and some smooth shapes like ellipses. Examples:



Each of the regular polygons above can be represented by any shape that produces ridged points at each vertex, and does not protrude beyond the polygon envelope. Vertices could have rubber tips for better traction on rough terrain. Examples:



The main driving force discussed so far is produced by gravity pulling downward. Other forces that could hold the car against a surface, and provide the moving force necessary to increment the car along, include aerodynamic, hydrodynamic, magnetic, electromagnetic, and electrostatic. Such forces could be independent of the car mass, and could thus propel the vehicle with much greater force and velocity. In some instances, these forces could provide their own means to move from wheel to wheel, eliminating the central motor used in the prototype.

The term "downward" is used to loosely discuss the direction of the force relative to the car when using a weight to develop the force. A more general description would be "normal" to the surface on which the car sits and moves. It may be possible to run the "car" on a vertical surface (wall) or upside down (on the ceiling) if forces other than gravity are used, such as aerodynamic, hydrodynamic, or magnetic.

In the case of immersing the car in hydrodynamic or aerodynamic flow fields, the car could use the energy of the flow field to propel it upstream, against the drag forces produced by the flow.

Devices are also possible where a rotating weight (moving force) can produce a reciprocating motion. If there are 2 wheels offset by 30° phase angle, the device would reciprocate. Further, configurations may be possible that "ratchet" along, in a 2 step forward and 1 step back motion. The motion does not have to be strictly harmonic (reciprocating) or strictly monotonic (rectilinear in one direction). There are also several methods for steering the car that are under development.

Powered versions of the 4 square wheel car where the wheels are directly driven but still phase locked and sequenced by 22.5°, will move over the ground with much smoother motion than a non phase locked version where all wheels can be flat on the ground at the same time. The prototype is surprisingly easy to push. A powered version with 4 phase locked wheels could be quite efficient, and may even climb better than the round wheel version.

Also see: Prototype Video

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