# Theory, DIY and proof: Newton's seemingly reactionless drives

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Since Newton it is known that reactionless drives are impossible. Nevertheless, it appears as if satellites and the ISS can rotate without reaction. We apply the underlying principle to a linear drive that can be built for a few dollars.

## *1. Introduction*

Since Newton [New1687] it is known that reactionsless drives are impossible. However, such systems seem to have long been a reality in rotations.

Between a momentum wheel with constant speed and the international space station there is a gimble [Wei2024]. When the gimble is rotated, the space station rotates in the opposite direction. Since the momentum wheel and gimble are hidden inside the space station, this creates the impression of a reactionless rotation. In reality, we only see the reactive part of „actio = reactio“.

In satellites commonly reaction wheels are used [Pat2025]. As soon as an internal flywheel is accelerated by a motor, we see the reaction force acts on the satellite.

Reaction and momentum wheels can also be combined. The reaction wheel generates rotation. Than the starting momentum wheel prevents reverse rotation when the reaction wheel is braked:
https://youtu.be/N9_r9pMoh3I

Linear drives can also be built using the same principle, which we successfully demonstrated two years ago [Mlod2023]:
https://youtu.be/8TAFZiXC4bY

All these machines use only Newton´s reaction effect. Although the linear drive also function according to the same principle of actio = reactio, it was doubted. It was claimed that friction was the cause of the movement [Mil2006]. Such speculations are refuted with a simple measurement.

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## *2. Theory of the forced accelerated pendulum*

In the following, only the law of conservation of momentum based on Newton is applied. Momentum is defined as: **p = m v = m a t = F t**

**Fig.1**

A vehicle can roll freely on the floor. On it is an inverse pendulum with the mass **m**.

A motor is mounted between the vehicle and the pendulum. The motor constantly accelerates the pendulum to the right along the distance **s** in time **t**.

To achieve this, the motor generates a constant force. An increasing momentum is generated in the pendulum over time. The vehicle reacts with a negative momentum of the same amount.

After time **t**, the motor stalls. The opposing momentums of the vehicle and pendulum cancel each other out and both stop.

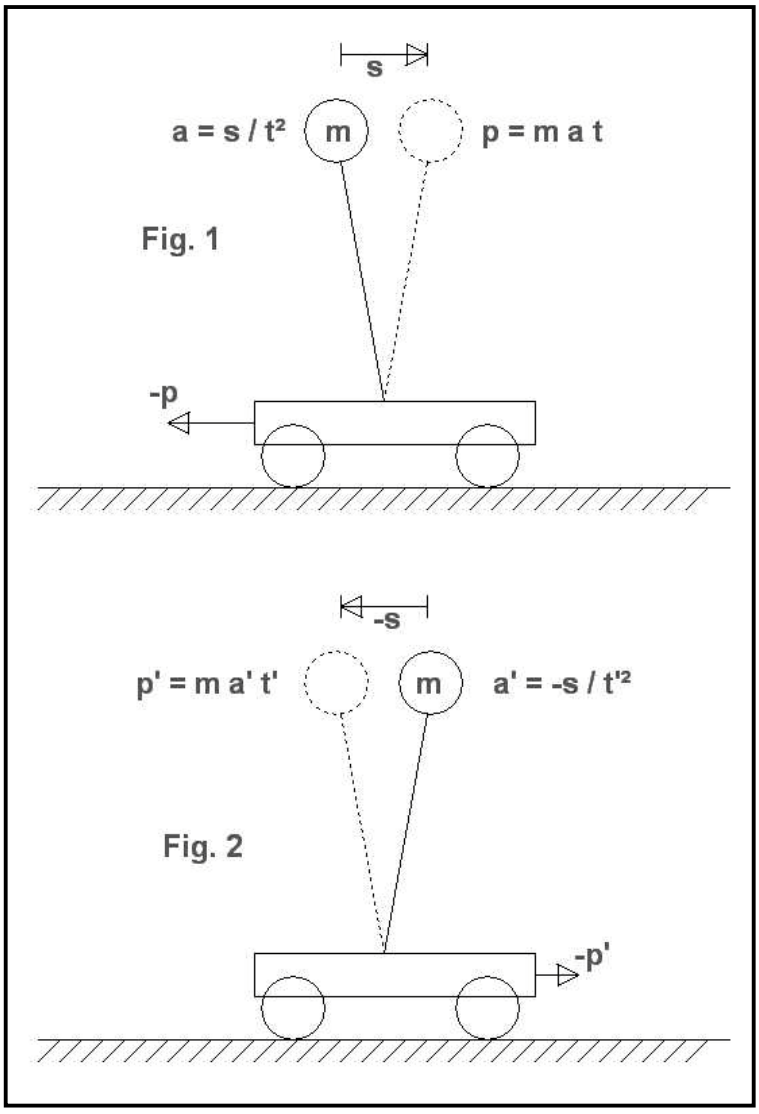
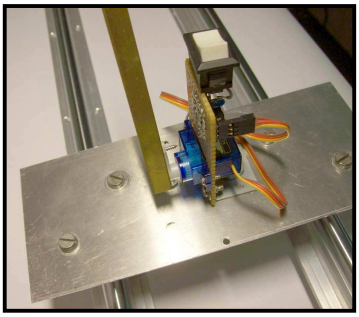
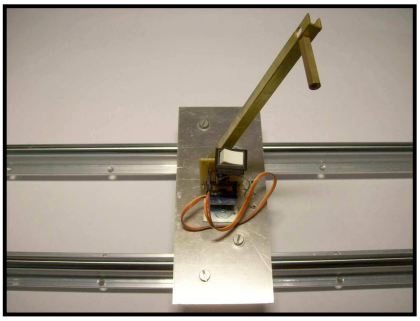
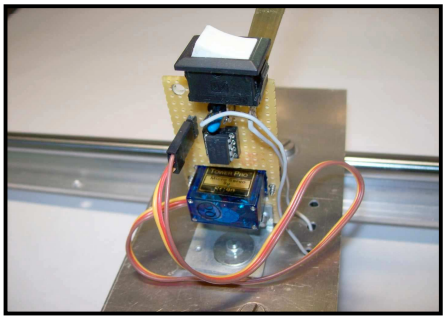



**Fig.2**

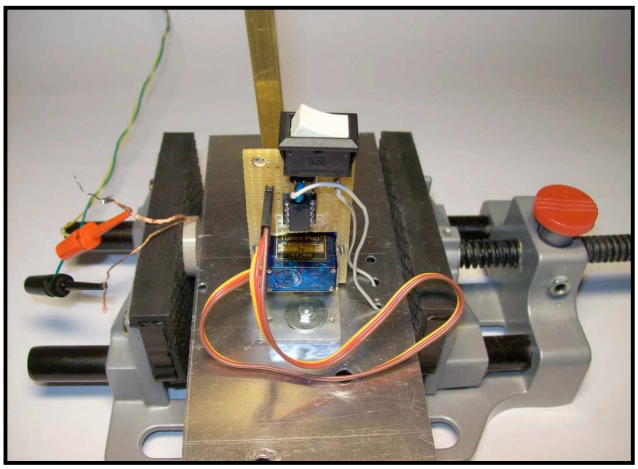
The return path -s of the pendulum is slower, e.g. **t'= 3 t**, which results **in a'= a / 9**. Despite the threefold integration time, the momentum **p'** remains three times smaller than **p**. The vehicle rolls to the left on average.

### 3. *Construction and measurement of a machine based on this theory*

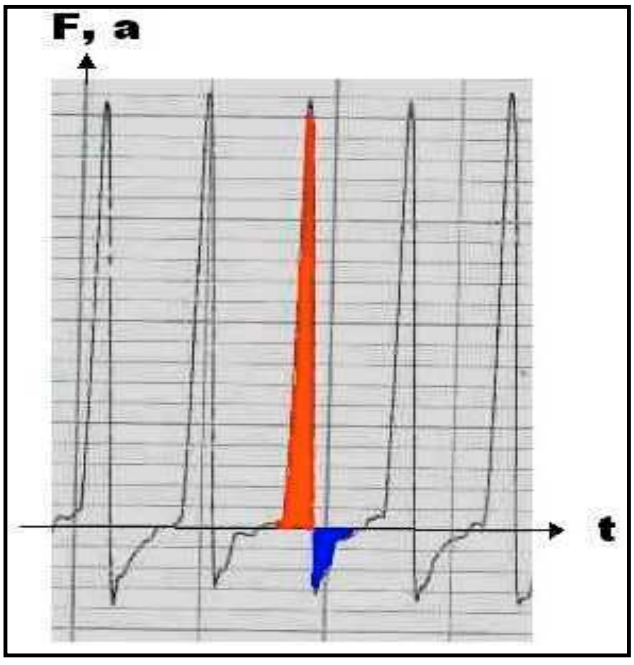
Such machines are well known, have been patented, built and successfully demonstrated many times. With a model servo, batteries and controller, the DIY setup can be completed in just a few hours: https://youtu.be/HV26SCLtmIE

It is predominantly claimed that the cause of propulsion is friction [Mil2006].



To test this claim, the machine is pressed against a piezo. The pressure enables symmetrical force measurement. As there is no movement, any friction is excluded.




The graph shows force (or acceleration) vertically and time horizontally. The expected ratio of 1:9 is almost achieved, even though the plotter is slow. The forward momentum is shown in red and the backward momentum in blue. The areas achieve the expected ratio of 1:3.

This results in an average thrust.

## *4. Discussion*

The linearity and symmetry of the measurement was checked by the zero result of the integration of three pulses with the same acceleration amount. Two pulses with half duration and one negative pulse with normal duration result in: **2(m a t/2) + (m –a t) = 0 [Nm]**.

We do not know whether the machine works in space. The measurement has shown that the thrust is not caused by any friction. Therefore, a pulsating thrust in space seems possible. However, it should be built with a mirror-symmetric system to suppress unwanted motion.

Our pulsating reaction drives requires different accelerations in the forward and backward directions. Since time is quadratic in acceleration but not in momentum, different momentums result in the forward and backward directions. The fact that no momentum is generated when the pendulum stops is also counterintuitive.

If the vehicle and pendulum are encased, the illusion of a reactionless drive is created,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