Energy recuperation:
recover lost energy when braking!

The fact that vehicles can recover power during braking and can save a lot of energy by doing so is a fascinating phenomenon which, amazingly, is still widely unknown.
Demonstration objects like the "Demobil" illustrated and described below can help to propagate the principle of the regenerative brake.

The regenerative brake – a little known principle

"Travelling at a fair speed on a level road, an electric car approaches a junction. While driving, however, the vehicle has used up all of its stored energy. At this moment, it has no more energy reserves left – apart from the energy of its own speed. The traffic light at the junction changes to red. The electric car has to brake and come to a standstill. When the traffic light changes to green again, the car sets off and smartly crosses the junction."

You are in good company if you find this story rather odd. "That's ridiculous!", "Where did the car get its energy from to start off like that?" were just some of the comments we received from university students to whom we gave this text. Only a small minority were aware that electric cars use their traction motors as generators during braking to generate power and recharge their batteries a little.

Lack of experience, obstacles to learning

As well as vehicles powered solely by electricity, cars have recently been introduced that can do this, too, by means of their hybrid drives (internal combustion engine + electric traction motor) and the railways have employed this principle for a long time. Nevertheless, why is regenerative braking so little known? One probable reason is that we fail to absorb the relevant information since it appears to be at variance with our own everyday experience. Whenever we experience our own attempts at braking (e.g. when cycling), we experience it as a two-fold loss: it requires the input of additional strength or energy and, afterwards, this additional energy as well as the original kinetic energy is lost forever.

Facilitate experience through demonstration

This gave us the idea of solving this lack of experience with the help of a specially designed toy. The aim is to demonstrate the principle of energy recuperation with a toy vehicle containing an elementary and clearly visible regenerative brake mechanism and to enable people to gain specific experience of the idea. The point is not the modern technology involved in regenerative brakes (which work electrically in cars and railway locomotives) but the principle of regenerative braking as such.

The simplest vehicle in the world capable of regeneration

DemoEx GmbH found an elementary solution. It is true that our demonstration vehicle, our "Demobil", is a crazy, unusable gag in terms of vehicle design. Nevertheless, it demonstrates the principle of regenerative braking in the simplest possible manner: as the vehicle consists of nothing more than a supple, curved steel spring, it can store its own kinetic energy when the vehicle is brought to a stop. The vehicle thus represents its own regenerative mechanism. As a result, a Demobil is able to demonstrate the "astonishing" story told at the beginning in an elementary mechanical way.

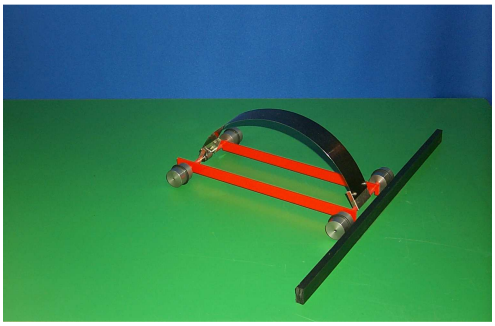
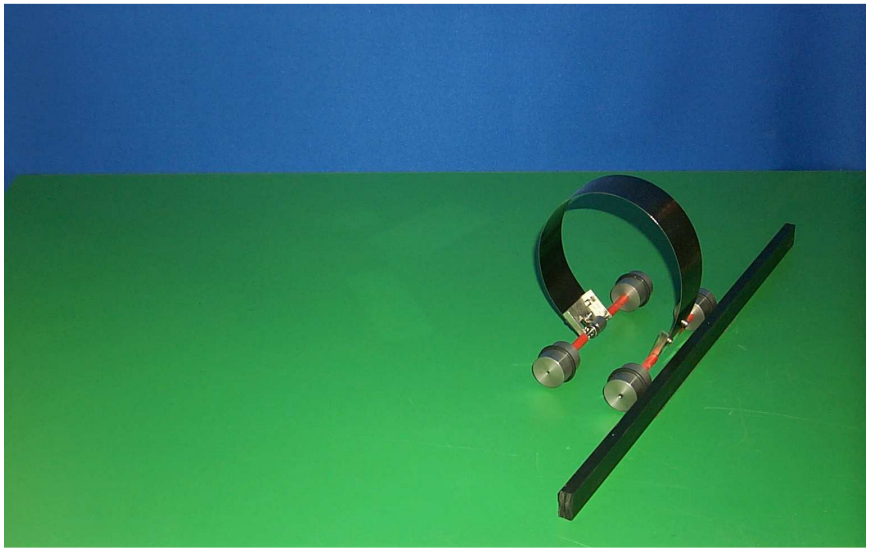


Fig. 1
As long as the wheelbase of the Demobil remains constant due to the two plastic rods attached, it cannot regenerate any energy when its own impetus (the vehicle is given a push by hand) is halted by an obstruction. If the obstruction is removed after the vehicle has stopped, the Demobil remains where it is.

Fig. 2
The plastic rods attached to maintain the vehicle's wheelbase have been removed. The vehicle is given a push again to make it roll at a certain speed over a level surface. If the front wheels are now stopped by an obstruction, the rear wheels catch up. They are braked by the steel spring, which they compress in turn.



As the rear wheels can only rotate in a forward direction (the axle to which they are solidly attached runs in a clutch bearing, which is a ball bearing that will only rotate in one direction), the vehicle remains where it is with its arched, tensioned spring. If the obstruction is then removed, the spring pushes the front wheels forwards: then the rear wheels are drawn forward and the front wheels pushed out again. The vehicle continues to roll along of its own volition at a funny jerky trot with the steel connecting spring arching and stretching alternately. For added interest, this jerky trotting motion can also be varied by placing additional weights on the front or rear wheels.

Price: Euro 400.-

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