GROUNDBREAKING INVENTION

The Israeli revolution of the internal combustion engine

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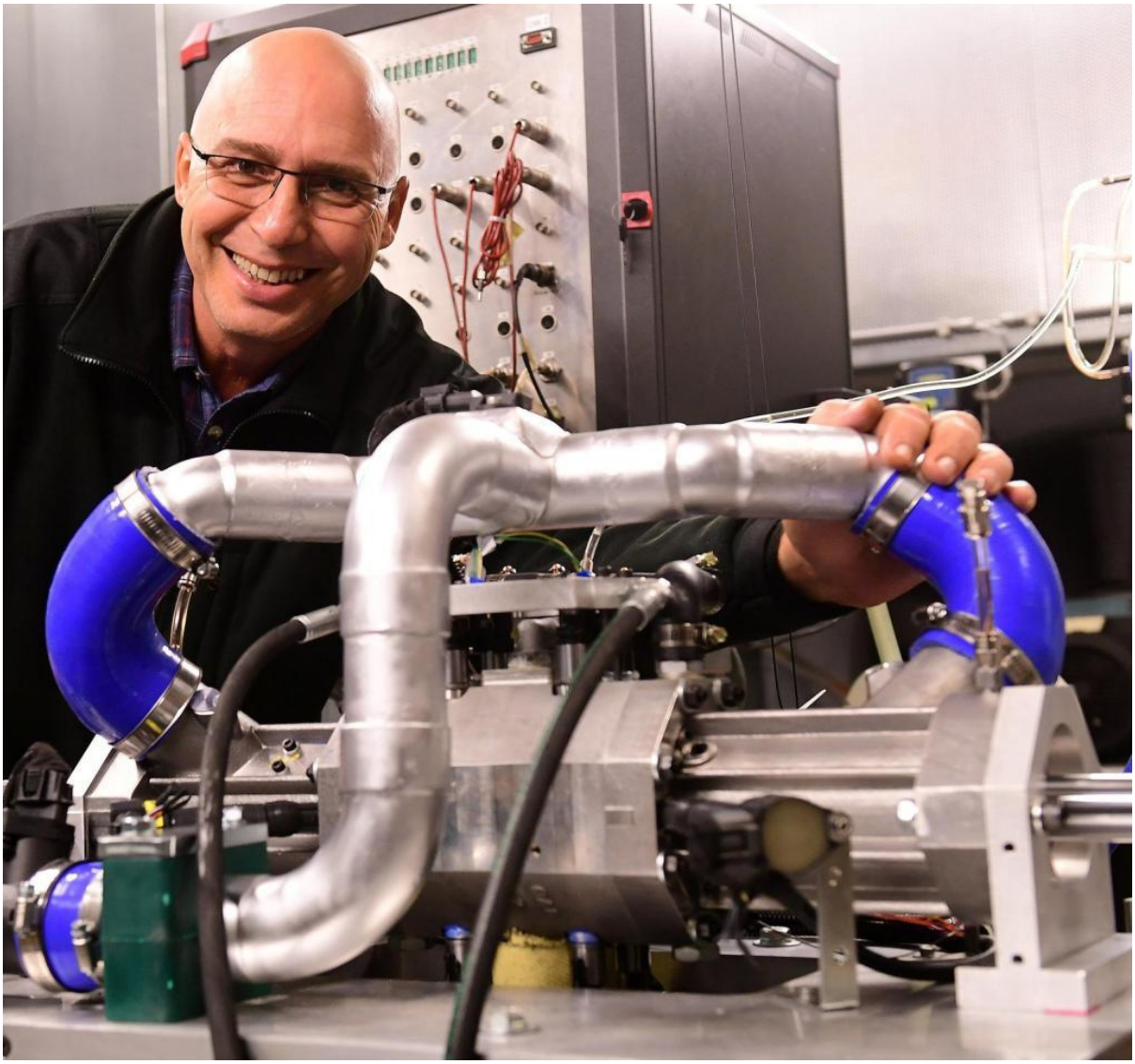
By Gil Yaron



Shaul Jaakobi presents the invented linear motor
Source: AFP / Getty Images

It is an invention that could revolutionize the drive system of vehicles, which has hardly changed for 100 years: a completely new kind of internal combustion engine developed in Israel. It is lighter, more economical and requires less maintenance - and has an enormous efficiency.

Gal Fridman still remembers the day he met the man who changed his life from the ground up: "He came into the room and said things that I did not understand. I was bored, "says the Israeli investor with a self-deprecating smile. At the time, he had no idea that this was a revolutionary technical innovation.

The former fashion photographer could not get excited when the stranger presented him with drawings of engines. What should be special about the pistons moving back and forth instead of turning a crankshaft?

"So what?", I wondered then and could not wait for the lecture to end. "But a co-investor who met with inventors at Tel Aviv in late 2014 with Fridman came up with ideas for new start-ups He was convinced: "If it really worked, it would revolutionize the world," says Fridman. So they invested their money.

Completely new kind of internal combustion engine

Today Fridman is a fan of engines. Instead of retiring, as the 58-year-old had promised his wife three years ago, Fridman now works as a sales manager around the clock in the start-up company Aquarius . Because from 2020 onwards, she wants to conquer the world with a completely new kind of internal combustion engine.

"You often hear of people who say they have reinvented the engine," says engineer Professor Roland Baar, head of the Department of Powertrain Systems at the Technical University of Berlin. The pressure to innovate is

enormous, after all, hardly anything has changed in the combustion engine for over 100 years.

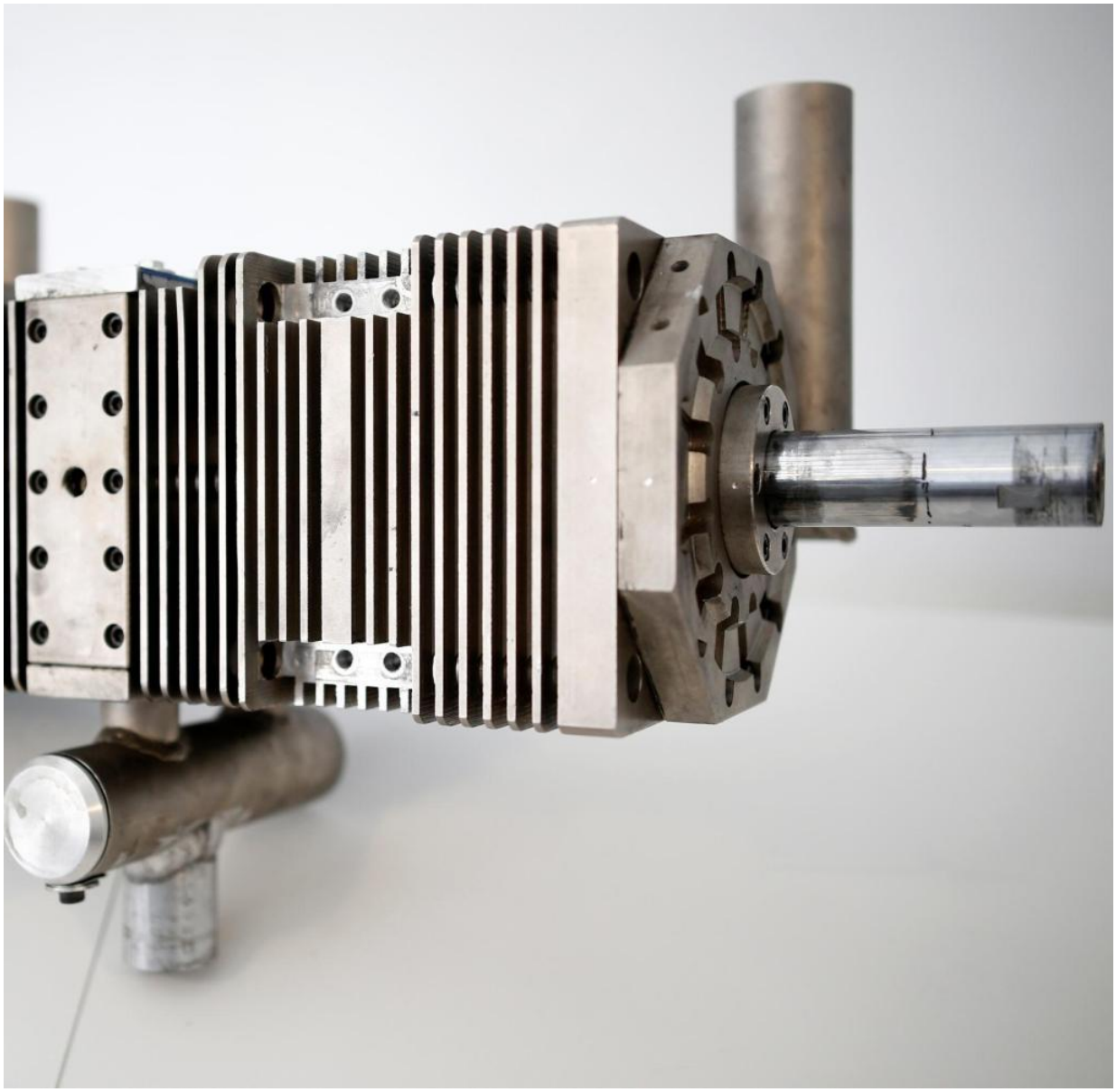
Whether a Ford Model T from the 1920s or the latest Ferrari: The drive works in principle the same. Pistons move up and down in cylinders driven by a fuel mixture that is controlled and burned every other cycle.

An engine of only twelve parts

The pistons thus turn a crankshaft, which transfers the resulting force to an axle. But this classic engine has many problems: it is inefficient, heavy, complex and maintenance-intensive.

All of this, says Fridman, should now be different: "Our engine weighs only about one-third of a comparable, conventional engine, at the same power. It is cheaper, more efficient, and since it consists of only twelve parts, of which only one moves, it is also almost completely maintenance-free. "That sounds almost too good to be true.

Especially when you consider that of all Shaul Jaakobi invented this new combustion engine. Jaakobi is not an engineer, has not studied mechanics or mechanical engineering. For this he has "from childhood on busy with engines," says the 52-year-old family man.



This is the prototype of the linear combustion engine. It generates electricity that can be used by an electric vehicle
Source: REUTERS

He grew up on a farm in Nahalat Yehudah not far from Tel Aviv: "When I was twelve years old, I repaired a tractor for the first time on my own. It was a Ferguson, "remembers Jaakobi.

In the army he also repaired engines. Later he founded a repair shop for engines, which became one of the largest in Israel. He sold them when he was 27, and became an appraiser for engines. Until he realized a fundamental problem four years ago during a professional visit to the United States.

This engine works linearly

"We were introduced to electric cars. But it soon became clear to me that batteries will not be able to store enough energy in the foreseeable future to offer an alternative to the internal combustion engine. And the generators that are used in hybrid cars are not yet good enough, "said Jaakobi.

So he set about solving this problem. For two months he tinkered: "That was no brainwave. I tried many things. Until I came up with the obvious solution: a linear motor. "

Its basic idea is simple: "An engine is a device that transforms one form of energy into another," explains Jaakobi. The chemical energy of the gasoline becomes the torque.

Prototype with 40 percent efficiency

But "there were so many parts that had to move. That means a lot of friction, where energy is lost. "In addition, there is always only one cylinder active, the process of ignition is complex and susceptible to interference.

"The most efficient known engine had an efficiency of about 50 percent," says Baar. But this optimum is only achieved under laboratory conditions at the so-called best point, "if one deviates from this best point, one registers significantly worse efficiencies".

This best point is almost never reached in a normal car ride. According to Fridman, the actual efficiency of a car engine is between 15 and 35 percent.

The prototypes of Aquarius supposedly already achieve an efficiency of 40 percent - and permanently. Because here only one piston - the only moving

part - moves from right to left, and always with the same, optimal frequency.

"Aachen is the Hollywood of the motor industry"

"There are no valves, no lubricants, only twelve components," explains Fridman. In fact, the engine does not generate any torque, but electricity. He is a generator.

To make the product ready for production, the Israeli company has now opened a research laboratory in Aachen: "This is the Hollywood of the motor industry," says Fridman. "In Israel, finding engineers for aircraft or rocket engines would not have been a problem. But who wants to build a good engine for cars, must go to Germany. "

For the time being, Aquarius wants to focus on another market: facilities that need their own power supply, such as mobile phone antennas for the new 5G network in remote areas.

"Around a third of the cost of power generation for such antennas stems from the high maintenance costs of the generators. They are not needed because our engine simply can not break, "claims Fridman.

This engine is also suitable as an emergency generator

He also wants to provide micro-networks with emergency power - from military installations to hospitals. Baar is skeptical: "Maintenance is unlikely to be eliminated, at least initially. Which hospital will run the risk of servicing its emergency generators only every few years? "

Fridman estimates, "An Aquarius engine for a hybrid car should be about as big as a bag in hand luggage and weigh no more than 20 kilograms." With such an engine, hybrid cars could become far cheaper than today's models, with a range of over 1,000 Kilometers per tank filling.

"They would be a mass product," says Fridman. Even the skeptic Baar finds this idea "clever, exciting the approach". From the mass production of a car engine, the company is, according to Fridman still years away. "She will have to take many technical hurdles," estimates Baar. That was difficult, but "certainly not impossible".