

CHARGING AHEAD

What do the potential huge future changes to lift-truck motive power mean for the humble lead-acid battery? And will hydraulic pumps and motors become a part of folklore?

A gradual evolution, with exciting advances in hybrid technology. This is how Richard Sadler summarises the next 30 years of development for electric power in industrial vehicles. Sadler is well qualified to make these predictions. He has spent the last 30 years working in the industry, and is currently serving as executive vice president for sales and marketing at Curtis Instruments.

"The backbone of this technology has been the lead acid battery" he notes. "Although the technology has been around for more than a century, we have recently seen great improvements in life and reliability. Also on the maintenance front, gel cell and valve-regulated systems have made big strides forward."

Over the next decade or so, Sadler believes the biggest improvements will come from the supporting technology. "If one considers the chemistry of lead acid, there is a finite level to which it can improve, probably only around 20-30% more. Where we can make a big difference, however, is with the monitoring. Both charge and discharge can be optimised, allowing a much longer life between charges. And to achieve this, we need a better

understanding of exactly what is going on inside the battery itself, so the instrumentation must also improve."

The intensity with which the battery is discharged is critical, while the temperature of the battery can be very important, ultimately determining the level of recharge required. The time that is available to achieve that recharge, such as during a 45-minute lunch break is crucial. In the United States, there has been a very strong move towards a faster charge at a rate higher than has typically been allowed in Europe, and Sadler observes, "The tests are not finished, but it would appear that the total life of the battery (say five years) is not adversely affected by these much higher rates of recharge."

This could mean a move towards more flexible, three-phase chargers, especially in the UK, with onboard chargers for smaller machines such as material handlers or street sweepers.

"What we need is an intelligent battery. This is what customers want. We need to be concentrating on battery temperatures, because if internal temperatures are



Richard Sadler:
"The biggest improvements to battery technology will come from the supporting technology"

exceeded either in the charge or discharge cycle, then it can lead to degradation. Operators need to let batteries relax, to allow them to achieve a more constant state, so periods of equalisation, allowing the temperature to cool are

important. Measuring the core temperature through the installation of probes will be vital." Sadler does not believe that using outer casing temperatures to extrapolate core temperatures is adequate – internal monitoring cannot come soon enough.

Hybrid solution

He also has clear views about the future of hybrid technology in the industrial vehicle sector:

"Personally, I think the growth and the development of hybrid solutions is exciting and fascinating, with some companies making huge commercially viable strides, although others are slow to see the potential. Don't for a moment think that there isn't a role for lead-acid batteries within a hybrid solution because

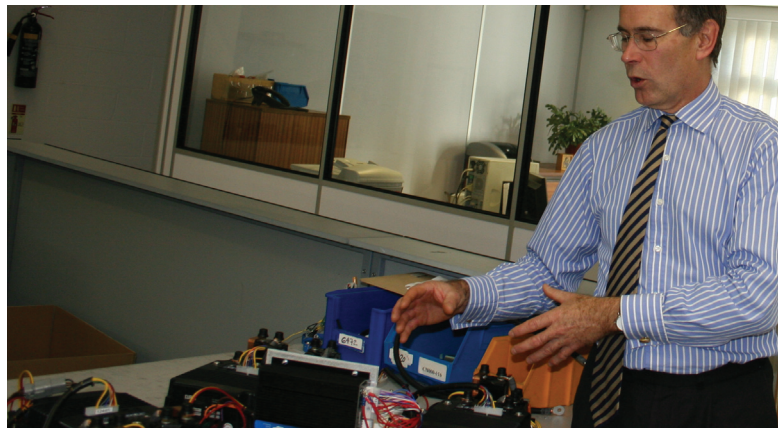


Greater battery control will lead to increased life between charges

there will be many applications that will involve some form of hybridisation where lead acid will be the storage method and provider of instantaneous power."

One driving factor will be the automotive industry. Sadler is "full of admiration for what Toyota has done with the Prius," and he also acknowledges that this will have a bearing on the industrial sector, especially with Toyota's counterbalance lift-trucks. He continues: "I predict increasingly smaller diesel engines for these types of machine, with the battery providing the high acceleration and lift speeds. This gives better fuel economy, by enabling the diesel engine to operate at its maximum efficiency, effectively at a constant speed to provide energy through a generator to the battery."

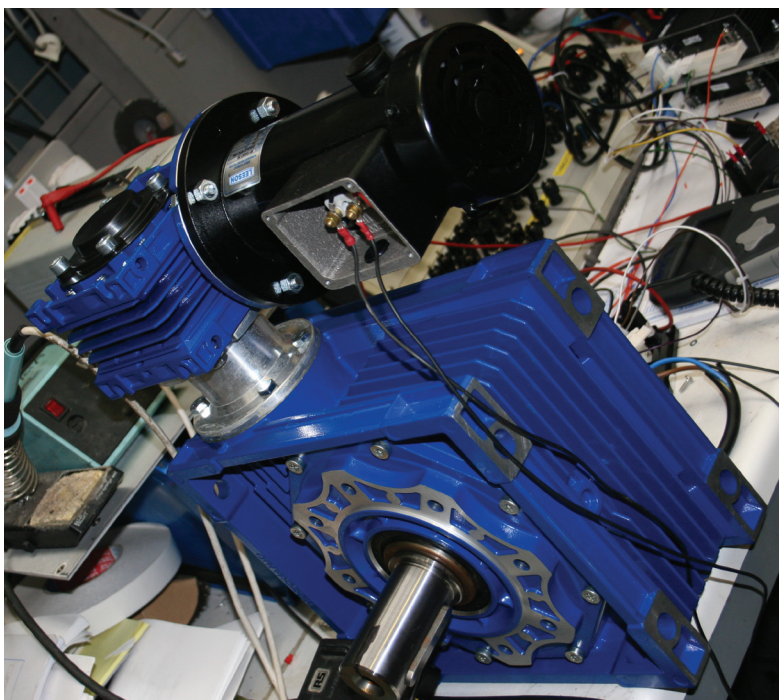
This could encourage the growth of greater electronics across the whole system, and possibly less hydraulics powering the various vehicle functions. "Traction, hydraulic lift, tilt, clamp and side shift – all of these functions have been traditionally run with hydraulic systems. Some may go to electric motor drives – we've seen that with steering, often when the original power-assisted steering was by hydraulic operation. Some companies have developed prototypes of forklift mechanisms without any hydraulic operation at all, purely done by an electric



Sadler predicts the biggest battery improvements will be made through better monitoring systems

drive. I still think the hydraulic cylinder is a very powerful device, and I don't see its demise happening over night, but I think the control of the hydraulic system will become electronic in the very near future.

"Today, most modern Class 1 counterbalance forklift trucks and Class 2 reach trucks have a motor speed controller governing the hydraulic system, i.e. an electric motor with a variable speed powering a pump. It's a huge benefit – only pumping that volume of oil required to provide the lift. The sale of motor speed controllers for the hydraulic pump function has been one of the recent growth areas for Curtis Instruments."

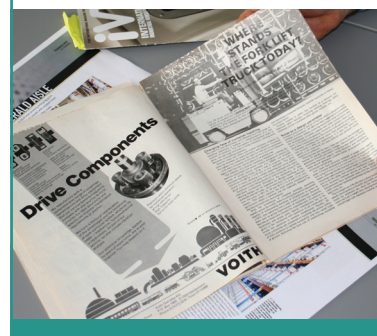


Curtis builds a variety of test models as part of its in-house research programme

Blast from the past

Three decades ago, while working for Coventry Climax, Sadler was interviewed by *Chartered Mechanical Engineer* magazine. He was asked to make his predictions for the next 30 years. "My brief was to talk about counterbalance trucks and I mentioned the importance of safety, the developments in battery technology, and the ways in which internal combustion engines would need to clean up their act in terms of emissions or electrics would take over all internal duties.

"I talked about the increase of lateral stacking trucks, container handling, and it is an interesting article to look back at after exactly 30 years. I think noise was another factor – a quieter environment is particularly important for the operator. So, I think what we are seeing is predominantly a gradual evolution, and while I did not foresee wholesale revolution, I've been fascinated by the development of articulated trucks."





Test mule used for research into reducing battery drain

The hard cell

Looking further ahead, Sadler believes that fuel cells will become a vital part of hybrid drive technology, offering a steady current to keep a battery charged. Research is underway, as he notes: "The situation today is that within the next one to two years, particularly in the United States, we will see substantial fleets of 10-20 vehicles operating in real-world environments. Companies such as Walmart are commissioning these to be built for warehouse duties as we speak. They will cover Class 1, Class 2, [reach and narrow

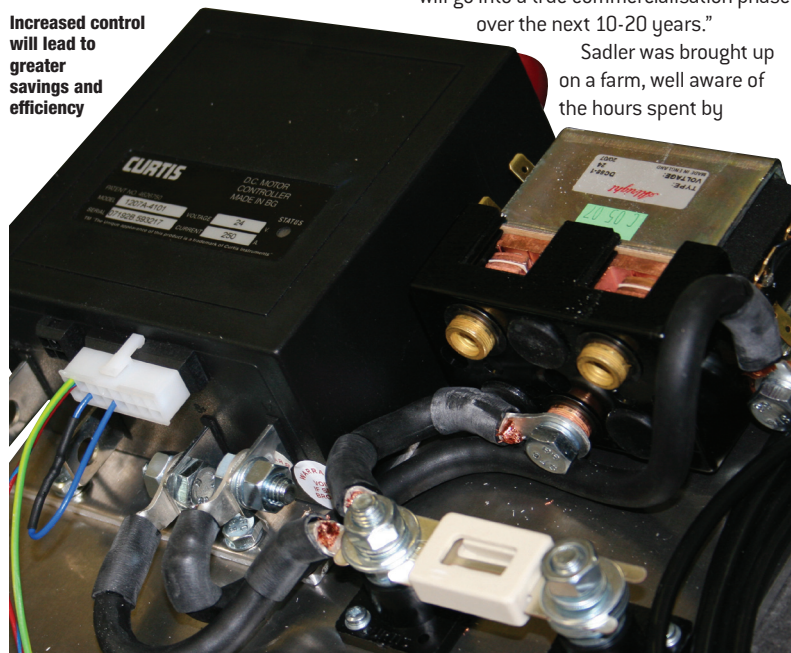


aisle] and there is some discussion about Class 3. Personally I think that these trials will last for around five years, during which time the fuel cell makers will be refining their designs. Then, with luck, the industry will go into a true commercialisation phase over the next 10-20 years."

Sadler was brought up on a farm, well aware of the hours spent by

operators sitting on tractors going up and down fields. "What a wonderful thing it would be if an operator could sit in the corner of a field, running three tractors via either some form of automation or remote control. AGVs [automated guided vehicles] achieved a growth spurt in the 1980s when many automotive factories adopted them. The experiment was not wholly successful and my guess is that, for probably 5% of applications, some form of automation has been adopted successfully long term. So it has become a niche, but I think it will expand, for example for operating in narrow aisles within cold stores. Also look at robotics in areas like painting and welding, with very unpleasant operating conditions. So if there are niche applications where materials handling needs to be done in an unpleasant environment, that is a very strong motivator to put in an AGV solution." **IVT**

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