Bruce Stanley takes a look at the past, present and future development of electrically-powered machines within the turf maintenance industry

On a charge

The application of electric motive power for turf maintenance has not travelled too far over the past 70 years.

Those who welcomed the introduction of the E-Plex battery-powered greens mower in 1994 may be surprised to learn that the name on the side of that machine is the same as that found on the world's first mains electric lawn mower, built and patented by Ransomes in 1926.

Produced in 14in, 16in and 20in versions, the Bowlic, as it was known, proved popular both for cutting bowling greens and domestic lawns. The major drawbacks, as with hand-held power tools later on, were the working restrictions imposed by the length of the lead and the ready availability of a suitable electric supply point, plus the constant danger of inadvertently snipping the cord in two.

Thirty or so years later, Ransomes, and others, attempted to overcome all three problems with the introduction of a battery-powered pedestrian lawn mower.

Although Ransomes continued manufacture of 14in and 16in machines until 1970, the mower never became a world beater due to the fairly basic lead-acid battery technology of the time. Arriving straight from the motor industry, the battery had to be large and heavy to hold sufficient power to cover a reasonable area of grass. If the sward became too long or thick, battery life was dramatically reduced.

Another problem was the need for frequent battery maintenance and recharging, tasks all too often neglected by the average homeowner, especially over the winter months. The

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Previous page: Cushman's expertise in the manufacture of battery-powered industrial trucks and work vehicles was used in the development of the E-Plex electric greensmower.

Below: The Ransomes Bowlic - a mains electric-powered lawnmower from 1926.

Facing page: The E-Plex offers economical, virtually silent operation with no pollution or concerns over oil leaks.

result? Costly expense on a replacement battery much sooner than the mower's salesman had forecast.

However, it is a different story when batteries are used throughout the year to provide motive power for commercial or professional operations. In such conditions, it is in the economic interest of the owner, manager or operator to make sure that the power source is properly maintained and regularly re-charged.

Demand for a battery capable of delivering and maintaining its rated output over a continuous, extended operating period led to the development of the 'deep cycle' battery which has thicker plates than the normal 'starting' battery found in road vehicles and tractors.

In the case of the deep cycle battery, both discharging and recharging take place over extended periods while the alternative starting battery is designed to deliver a high current over a short period, vital when cranking a petrol or diesel engine.

The major design characteristic of the deep cycle battery is its ability to discharge up to 80% of its stored power over a very high number of cycles. The final number will depend on its rated capacity and the operating conditions, temperature and maintenance schedule, but should not be less than 450 cycles for a six volt battery.

The first electric vehicles used on golf courses appeared in the USA in the early 1960s. Derived from industrial work trucks, these golf carts or "buggies" rapidly achieved great popularity, transporting golfers quickly, conveniently and quietly between shots.

This last point was very important on the many new courses being constructed as part of residential and resort developments, close to private houses, hotels and holiday homes.

The status of the buggy was soon confirmed by the installation of purpose-designed cart tracks adjacent to fairways on many of the new courses built in the USA from the 1960s onwards. As a result, 80% of the courses "over there" now have electric golf carts, with North America taking the lion's share of a total annual world market put at 150,000-plus vehicles.

In the UK it is a totally different story, with electric carts currently available on less than 10% of courses. The reasons include a lack of suitable and dedicated track ways on which the buggies can run and an apparent ingrained resistance to the use of battery motive power. And it's been a similar tale when it comes to grass-cutting machinery.

The world's first ride-on electric greens mower made its debut at the GCSAA show in Dallas in early 1994.

Coming from the same stable as Cushman, the Ransomes E-Plex made use of Cushman's long experience in the manufacture of industrial electric work vehicles. In fact, the E-Plex's electrical technology and major components - batteries, drive motors and switch gear - were all derived directly from the Cushman development programme. Ransomes concentrated on the cutting units, operating platform and novel features such as the swing-out centre unit, facilitated by the absence of any hydraulic pipes.

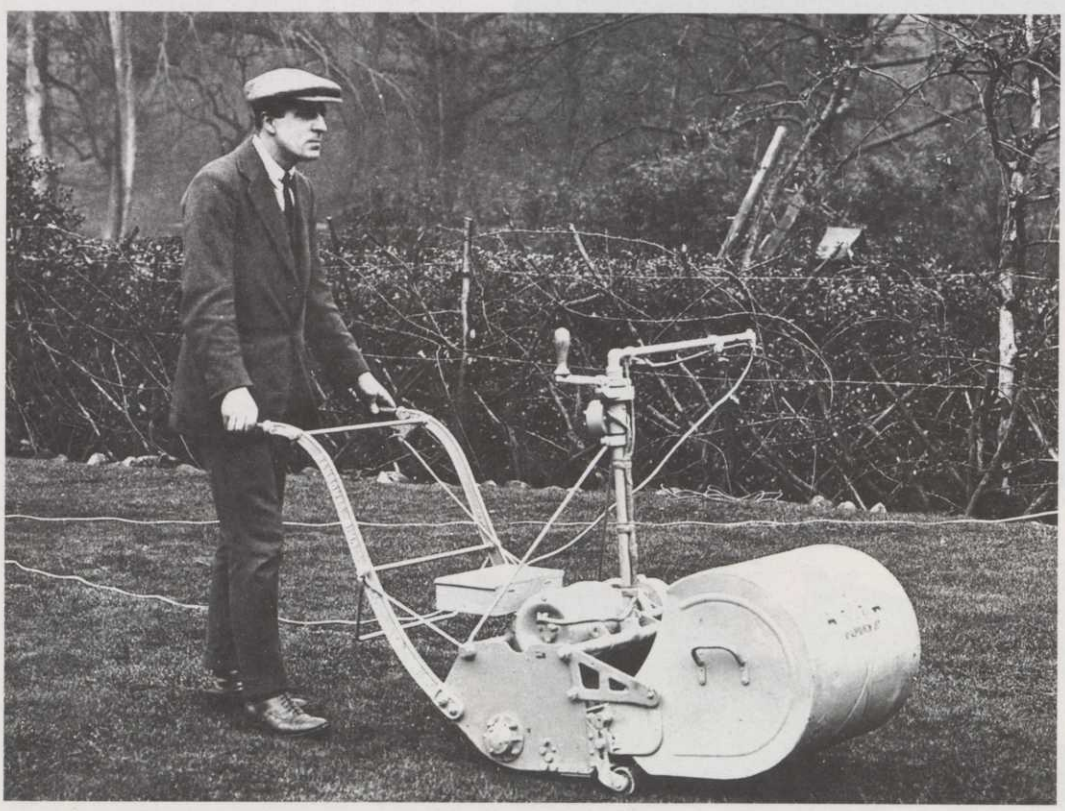
The silent, pollution-free operation of the E-Plex proved an immediate attraction in the USA, particularly on courses within residential and holiday complexes. Sales were led initially by the E-Plex's environmental features, but users quickly discovered a further benefit in dramatically reduced maintenance requirements and running costs compared with an equivalent petrol or diesel-engined machine.

Annual savings of 50 per cent are not uncommon, with one public authority in the UK recording total maintenance and running costs of just over £1,000 in three years, making the E-Plex one of the most economical machines in its fleet. This machine has also proved the doubters wrong by cutting 19 greens on a hilly course without faltering, always returning safely to the shed for overnight recharging.

The technology used by Ransomes and Cushman in the original E-Plex and E-Plex II greens mowers has since appeared in the Jacobsen Greens King Electric, launched in 1997.

Any machine which works on or close to golf greens or tees at any time of the day needs to be as quiet as possible. So the next logical development following the electric greens mower was the self-propelled bunker rake, answered by Jacobsen in 1998 with the Sand Scorpion, which uses the same battery pack and wheel drive motors as its greens mower.

At the 1999 GCSAA show in Orlando, Ransomes unveiled a prototype electric walk-behind greens mower equipped with a single 12-volt battery, bringing back memories of



the original battery-powered mower first produced by the firm back in the 1950s. Today's battery pack is somewhat smaller.

Yet, as in the motor industry, it is the number, size and capacity of the currently-available batteries which is limiting the development of electric power within golf course maintenance.

It is one thing turning the wheels, but it is quite another to drive cylinders, groomers, verti-cut units and other attachments and never quite knowing how long the batteries will last before the machine comes to a halt. To avoid this, both Ransomes' and Jacobsen's electric mowers have circuitry which automatically cuts out drive to the cylinders when the batteries fall to a 30% charge level, leaving sufficient power to return to the sheds.

The introduction of the deep cycle battery helped extend working life greatly, but it is still a lead-acid battery. Although its capabilities have improved significantly over the past 20 years, such batteries remain bulky and weighty in comparison with a petrol or diesel tank.

There has been talk of battery-powered fairway mowers, but battery technology is not yet sufficiently advanced to provide enough power to mow all the fairways, and travel between them, and provide a mower which is not too heavy or cumbersome.

The alternative is likely to be a hybrid combining an internal combustion engine and battery power, switching from one to the other depending on the proximity of golfers or buildings.

As for turf maintenance vehicles, the diversity of their tasks makes it virtually impossible to estimate how long the batteries will last before they need recharging. The same goes for other machines for which electric power would be acceptable, simply because of the unpredictability of the load. It is therefore unlikely that lead-acid batteries will be used on their own to power on-course vehicles other than personnel transporters, greens mowers and bunker rakes.

But what of the future? There is growing excitement over the development by American company, Metallic Power, of zinc/air fuel cells as an alternative to lead-acid batteries.

Fuelled by zinc pellets which combine with oxygen to produce electricity, the system is said to have three times the energy efficiency of a petrol engine. There are no emissions, the fuel source is totally recycled and recharging takes only five minutes. In tests, zinc/air fuel cells have delivered four to seven times more energy per pound weight than traditional lead-acid batteries.

Leading companies within the turf industry, including Textron, are now working closely with Metallic Power to maximise the performance and efficiency of this new power source in practical applications. As the saying goes - watch this space!