

electric tricycle conversion: statement of capability



Tricycles represent a very small part of the bicycle market, but they are ideal for people that need to carry stuff or don't have the balance for two wheels - and recumbent trikes are huge fun! Quality tricycles are relatively expensive: Pashley trikes cost upwards of £650, tricycle conversions (the 'tribike', the only one I know, now that Longstaff has finished) start around £450 while the standard 'Far Eastern' trike such as the Mission (www.missioncycles.co.uk) can be immensely heavy.

The most straightforward solution for a Tri-1 or a Picador without a front hub brake is a hub motor. Hub motors need support on both sides (though I have seen a wheelchair hub motor on a stub axle). This picture shows a Heinzmann 36V system that is controlled by means of a twistgrip throttle on the right hand. Note the hinge halfway down the main tube. This lets the front wheel fold between the rear wheels, and the handlebars are secured on a toggle clamp that allow them to be lowered.

The Heinzmann is a sturdy system, but quite expensive at ~£780+. The motors can be fitted with a 3rd-party controller and a better (LiFePO4) battery. Pashley puts two brakes on the front but it is possible to move the hub brake to its original position on the offside rear wheel, but this involves shot-blasting, welding and re-coating at ~£120

The disadvantage of a hub motor system is that it only has a single gear and so is a compromise between hill-climbing and speed.

In 2003 I started working with the Cyclone system (www.cyclone-uk.com) whose main benefit is that it powers

With several types of kit available and some ingenuity I have motorised quite a few trikes to achieve a (relatively) light machine that can deal with hills up to 14% while also providing a decent top speed and a pleasant ride. I have dealt mainly with the Pashley 'Picador' and the 'Tri-1' (formerly made by Cresswell Engineering) as well as a range of recumbents.



the chain or chainwheel and so, like a car or motorbike, it powers the trike through the rear gears. This system has

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been developed both by its Taiwanese designer, Paul Lin, and by me to make it a very adaptable system with several options

This **Tri-1** was built with a specific hill in mind: Park Street in Bristol. Park Street strikes fear into the heart of the most energetic cyclists who boast about how far they can get before having to walk.

The Beast of Park Street video is on YouTube as proof! Shot with my right foot in the frame as evidence that the climb was done almost unaided.

The battery can be carried on or under the rear rack or inside a rack-pack as above.

The Cyclone motor is fitted below the bottom bracket and the chain was extended by 10 links so it wraps around the Cyclone sprocket. The motor was fitted near to the chainwheel to allow the rear gear shifter a full range of movement.

The picture below show how the motor is fitted with the chain driven by the motor. The chainwheel is fitted with a freewheel ensuring that the rider's feet are not pushed round by the motor.

Because the nearside pedal must pass over the motor an eccentric bottom bracket is fitted to extend the nearside crank.

and configurations and I also use 'nano' hub motors (www.electricwheel.co.uk) in interesting new ways...



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Now that two chainwheel-drive options exist (Cyclone and Presto) it is possible to mount the motor further away from the bottom bracket/pedals so the eccentric bottom bracket is not required. The ideal position is in the triangle behind the seat post.

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The Pashley **Picador** has an unconventional setup, having a hub gear driving a sprocket and then a chain onto the rear axle. Unlike the Tri-1 that has a split axle (only the nearside rear wheel is driven) the Picador axle is solid, driving both rear wheels at the same speed.

To accommodate wear in the chains, the chain from the chainwheel to the hub gear has a chain tensioner and the chain from the hub gear to the axle is adjusted by moving the hub gear.



This picture shows the 'first fit' with the motor mounted to the frame with the chain and tensioner.



Final fit to the bike with a large battery case for Lead Acid batteries. No eccentric crank is needed because the motor is mounted further back than the Tri-1

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Other Bikes



▲ A Cyclone fitted to a recumbent trike using a double-freewheel motor



▲ The 'Presto': Cyclone freewheel double-chainwheel powered by a 'nano' hub motor ▼



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Chain-drive Giant Revive ▲ Chainwheel-drive (MTB) ▼



▲ Carbon-fibre print covers make a nice finish ▼



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Batteries

The biggest strides in development have been made with battery chemistry. In 10 years there have been 4 major steps:

- Lead-Acid batteries (SLA) are a cheap way to store power and deliver high currents, but they are very heavy, are very large in relation to newer chemistries and a short service life;
- Nickel-Cadmium (NiCd) and Nickel Metal Hydride (NiMh) are both much lighter than SLA but Nickel and Cadmium are toxic and environmentally undesirable, they both need sophisticated charge management, NiMh gets hot during high discharge, neither work when cold and NiMh 'leaks' power at 1% per day, so needs frequent topping up;
- Lithium Ion is almost universally used in small portable equipment and a 'scaled up' battery with management

Prices

The motor kit ranges from £350 to £700 depending on power and type of drive system.

The LiFePO4 batteries range from £250 to £450 depending upon capacity (distance required). A case is usually based upon ordinary cycle luggage at about £65, including fitting the charge socket, switch, indicator and output cable.

electronics can deliver modest current for electric bikes. Higher voltage (36V or more) is preferred to minimise current and prolong life;

- Lithium Iron Phosphate (LiFePO4) is safe, robust and has a long life expectancy (1,000 charges or more).

In order to secure a sound understanding of LiFePO4 batteries and to establish a service and repair capability in UK I have forged a link with Ping Batteries (www.pingbattery.com). Should a battery develop any problem a 'Return to China' warranty would be a severe deterrent to UK customers and so I replace any electronics or cells using parts free-issued (under warranty) or purchased from Ping Batteries.

Fitting the kit varies according to any need for custom components or adaptations: a basic installation takes about 3 hours which includes chain extension, tension, motor mounting, chainwheel exchange and wiring.

Accessories

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I also offer self-powered lighting this includes a converter to 12Volts and one or more light pods and a rear light. Also

available is a 5V converter that can be used to run/charge a 'phone, SatNav and music player