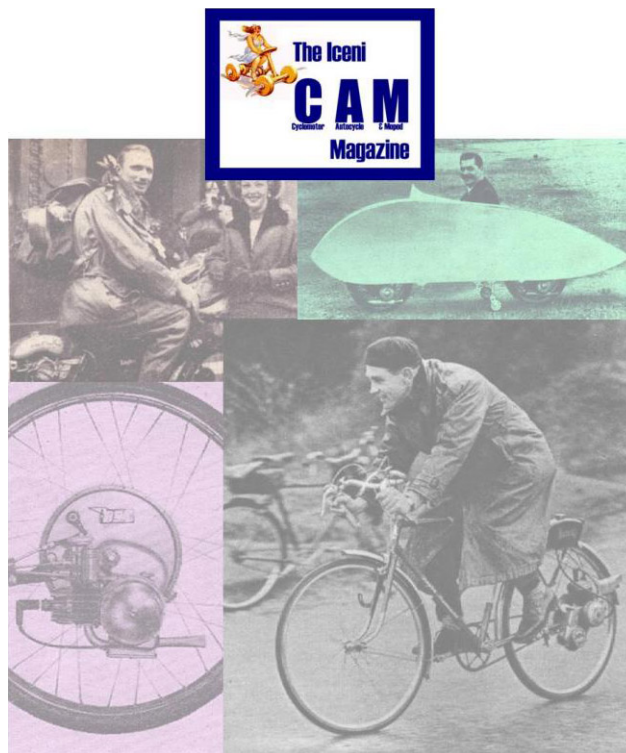
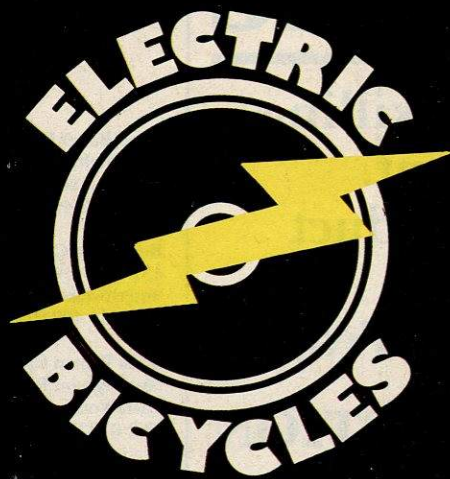


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The Spark Gap

IN 1984 the Department of Transport announced new rules to allow electrically assisted bicycles on to the road without a licence. In 1985, apparently determined to prove that governments can create a gap in the market with the wave of a White Paper, a host of designers rushed to fill it. The most spectacular entry was by Clive Sinclair with his C5, but there were plenty of others with equally high hopes even if they wielded less hype.

For all of them, there were two questions to be answered: What sort of vehicle would people want? and, Can it be built?

Sinclair made a good stab at the first - those advertising promises were pretty attractive - but came a cropper on the second. Others played themselves into the game more cautiously.

BA took a look at three leading contenders in the Electric Assist (Two Wheel) Stakes, to see if any of them have come up with a satisfactory answer to both problems...

FLEECING the unwary is an honoured tradition in transport. From the first sucker stiffed with a blind hay burner to the last luckless soul left attempting to devise a useful application for the Sinclair C5, people have been more interested in promises of ease and speed than in observable reality. Hence the profession of used car salesman.

For everyone interested in the development of new, interesting, effective, low energy forms of transport observing patent reality, the C5 must serve as an awful warning. The incredible thing is that it was made at all; as a practical mechanism it was doomed from the outset. It made an impression because a King's ransom was spent on marketing - a very polite term for a string of fairy tales like 'twice the speed of a bicycle' - and only now that you cannot give away a C5 has the Advertising Standards Authority bravely announced that the 'misleading' performance claims will be 'amended or withdrawn'!

Only a moment's thought is needed to realise why electric cycles have never set the world on fire. The battery technology needed doesn't exist yet. Almost all the extra power you can get out of current batteries is needed to shift the weight of the battery and motor. There's very little left to assist human power and what there is usually has to be cut out to protect the equipment when a serious load is imposed - on a hill for instance - which is just where you need the help. The electric bike's main competitor is the non-electric bike, and so far for most people the non-electric bike is faster and easier.

That's why petrol engine mopeds are the dominant type of low motor pow-

er cycle. The ubiquitous and popular French Solex uses a small diesel motor that rides on the front wheel. Even plain pedal cycles are faster, less work, and safer.

But some sort of motor assist is such a good idea that it is still worth pursuing.

'The pleasure of cycling, the luxury of power.'

'At the mere touch of a simple control, a powerful electric motor will take slight gradients in its stride and, with some pedal assistance, steeper hills. Suitable for all age groups from teenage to old age.'

'A new power in personal transport.'

'...enables the rider to tackle hills which would be too difficult to pedal alone.'

'...the simplest, safest, most stylish form of personal transport this decade.'

-- Selection of advertising copy for electric bikes

The human engine is amazingly flexible, but its power output is very limited, a little help at the margin is obviously desirable. This is especially true of those whose natural physical powers are restricted. The fundamental question: Who would use it?, is hard to answer, though an electric bike that worked might make a perfect present for an elderly relative.

Weight is the fundamental problem. Most electric cycles are the best part of 100 lbs and can only be managed by the stout of limb. Anyone who needs electric power assist because they are, through age or infirmity enfeebled, will need help just to lift one of these things over a kerb.

And that's just the start of the difficulties.

Even if these natural restrictions on electric powered bikes can be overcome, there are the man made ones of the 'Electrically Assisted Pedal Cycle Regulations' devised by the experts in the Department of Transport. These limit maximum speed to 15mph, and power to 200W (250W for a tandem or tricycle). That simply isn't enough. Unless the way forward is downhill, powering one of these gadgets off the mark takes serious muscle. So does ascending any kind of hill. If the motor overheats and goes dead, as most of them do at the first call for spirit, only members of the Tarzan brigade will be able to carry on.

Assuming that you manage to get one of these items of 'ultimate two wheeled transport' upright and rolling, you may well find that it only stops at the mortuary. Retarding all that extra weight takes serious muscle and serious braking equipment. Of the bikes tested, only one had anything like an appropriate level of braking power.

So thanks to governmental legislation, anyone age 14 and up may drive on the roads without any kind of training, license, insurance, or even a helmet, using underpowered, unwieldy vehicles with abysmal brakes. This is a sure fire recipe for disaster.

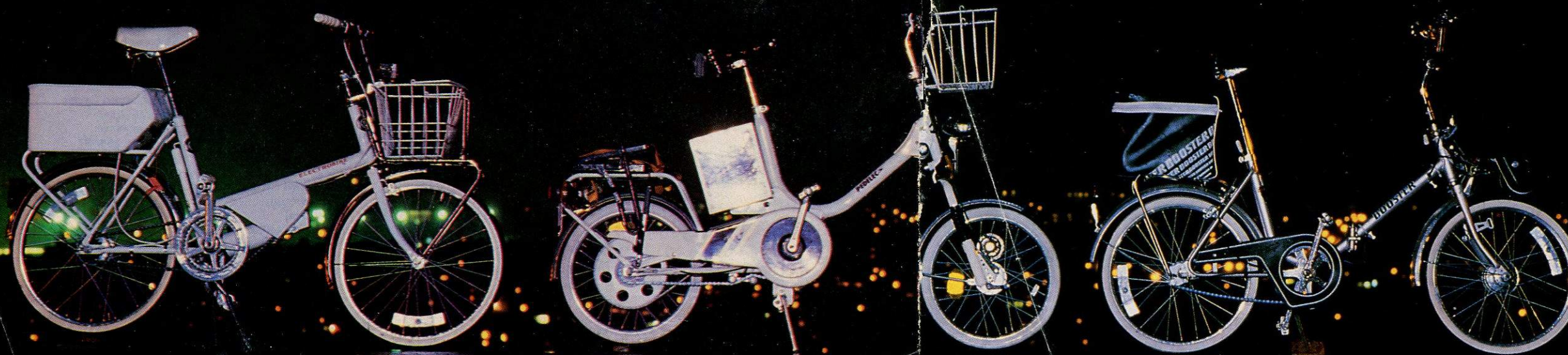
Usually, when you're using motors, there's enough brute power involved to blast through most of the little difficulties in the designer's way. That's not the case with electric bikes. The margin of useful extra power is so small, and the extra requirements made of the bicycle itself by the extra weight so considerable, that if the design is at all clumsy 'Cycling with the luxury of power' turns out to be harder work than without it. On the other hand, with skill and luck it might be possible to squeeze enough extra out of the set up to produce a net gain.

The C5 had many ingenious features but they paled before the overwhelming fact that as a vehicle, it was a dog. All these test vehicles had at least one advantage: beneath it all they are bicycles and that gives them a head start as a form of personal transport. Have they built on it, or have they thrown it away?

BOOSTER

THE BOOSTER is a cheap 20" wheel folding bike with a 120W motor mounted over, and driving, the front wheel. The battery is carried on a rear alloy pannier rack. The motor is a single speed, controlled by an all or nothing button on the handlebars. There's a 3-speed hub gear for the pedal input.

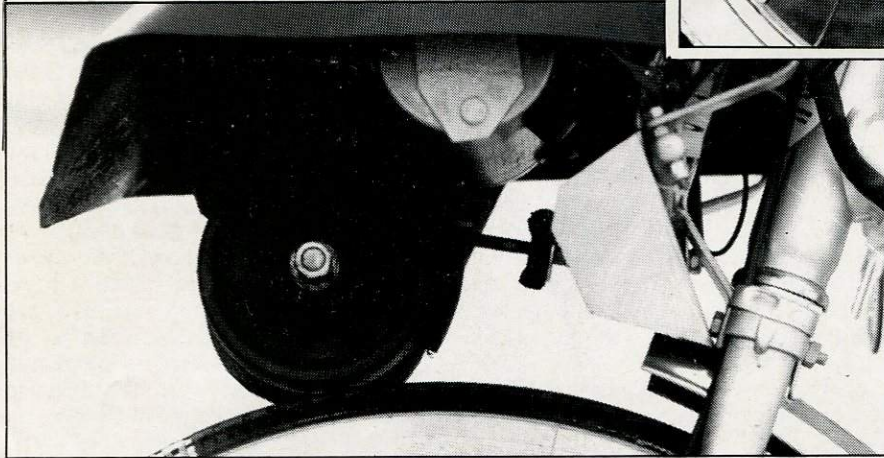
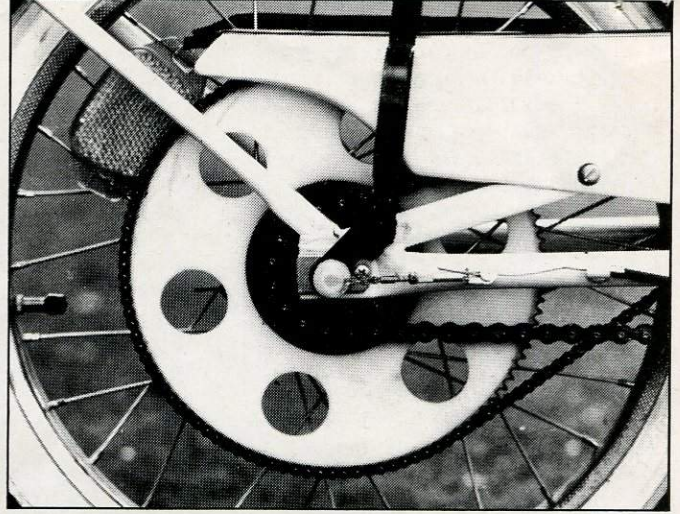
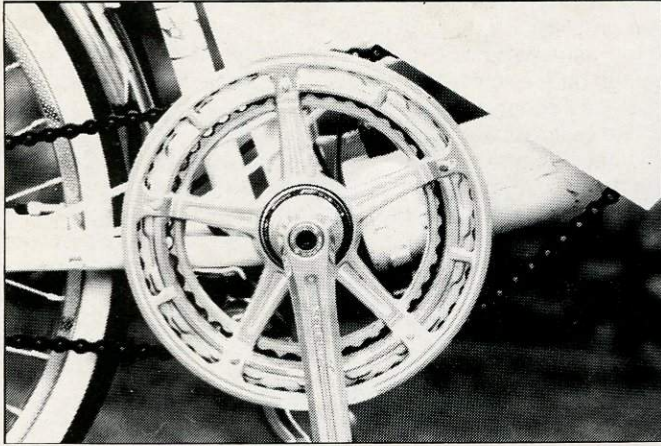
If the way forward is level, or downhill, moving off can be done on electric alone. This is nice, because the poor distribution of battery and motor weights makes low speed handling thoroughly unstable. You want at least one foot on the ground until the Booster is moving solidly.



ELECTROBIKE 200: £397

PELELEC STELLA: £325

BOOSTER: £249



Richard Francis

THREE ways to drive a bicycle with an electric motor. The Electrobike (top left) has a clutched chainwheel; the Pedelec (above) drives both motor and pedals through the three-speed freewheel, and the Booster uses a direct friction drive on to the front tyre.

The Spark Gap

Unfortunately, if there is even a slight uphill gradient - like moving off from a kerbside and climbing onto the crown of a level road! - using the motor alone will cause it to overheat and die instantly. Nor can you simultaneously pedal and engage the motor. **FIRST** you pedal and **THEN** you cut in the motor. This is a fair trick. Shifting out all that weight is a hard slog, especially when much of your attention is going into coping with awkward and tricky handling. It's the last thing in the world to wish on your Elderly Relative.

On level ground the electrics roll the Booster along at only a little faster than a jog. You've still got to pedal if you want to get anywhere. Fair enough. At least you can pedal to some appreciable result. The moment of truth comes when you encounter one of those slight gradients that the Booster is supposed to 'take in its stride'. Even with both electric and pedal power full on, any wreck of a bicycle powered by any wreck of a human being will drone on by the Booster as if equipped with wings. It's quite embarrassing. As for steep upgrades, even if you pedal the Booster for all you're worth the motor dies within 20 or 30 yards. If you wait until the motor re-surrounds and bring off a tricky uphill start, another death will follow in seconds. The fact is, the electric power is unusable just when it is most needed!

The only time the Booster stretches out and moves is downhill. This is when

you find that the braking arrangements are also not very clever. The rear brake is a calliper with rubber blocks meeting a steel rim. It is about as useful as dragging an empty tin can. The front brake is a much better hub type. But it is distressing - and quite unsafe - to have only one means of stopping, and in the wet the combination of tremendous, unstable mass, and single, front wheel braking, is absolutely terrifying.

The riding position puts all of the rider's weight on the flimsiest, most uncomfortable saddle obtainable. Only a few miles is needed to produce an extremely sore bum. Throughout the test period bits and pieces of the bike rattled loose and fell off. No way are the wheels going to last. The Booster is just a

HOW FAR WILL THEY GO?

A RANGE of 15-20 miles is claimed for the Booster, and 25 miles for the Electrobike 200 and Pedelec Stella. The machines are heavy, and no one wants to find the limit the hard way. Fortunately, all are equipped with some kind of battery condition indicator, and a battery discharge meter. One quickly learns how to balance the electrics with pedal input to minimise drain, and there's ample warning if the end is near.

Recharging takes about 12-14 hours and is generally reckoned to cost 5 pence. It takes about 12 discharge/charge cycles before the batteries build up full capacity.

cheap, nasty bicycle with a battery and motor tacked on: a dreadful, amateurish bodge.

ELECTROBIKE 200

THIS is manufactured by the TGA Tricycle Company, who have been producing electric trikes for some time. At first impression their effort looks creditable.

The motor is a hefty 24 volt/200W unit drawing juice from two 12 volt batteries, pushing simultaneously with the pedals through a Sturmey Archer 3 speed hub. This is an enormously more flexible and useful system than an all or nothing single speed. A slight hitch developed with the shift control - a semi-automatic button upshift model made of the latest in flimsy plastic - which fell to bits, gnashing a tester's hand.

The brakes are hub rear and calliper front. This is a better set-up than the Booster's, but the calliper brake is useless, and a single hub brake is simply not robust enough for the enormous weight of the Electrobike.

Because it weighs a ton. Where one hale person can pick up a Booster bike and hump it up a few stairs, two are required for the Electrobike. Whatever advantage accrues from the powerful motor and dual batteries is lost in sheer mass. What's more, the batteries are mounted on a carrier over the rear wheel, creating tremendous weight bias; handling is improved enormously if still more weight is added to the front basket!

On the road, given a downhill start,

unobstructed level run, and lots of room for stopping, the Electrobike 200 goes along fairly well. Throw in some stop and go traffic, a few gentle upgrade starts, and a sharpish stop or two, and the sweat really flows. As for long, steep downgrades, the word is simply: DON'T!

PEDELEC STELLA

MADE by Stellmar Ltd., who have been enthusiastically predicting that the Chinese will take it up in large quantities, the Pedelec Stella is far and away the most advanced electrically assisted bicycle seen so far. It works! This accomplishment - lost to the other contenders including Sir Clive Sinclair - is the result of being thoroughly designed for its purpose, proper building, and attention to detail. The result is a machine that establishes a distinctive position between a bicycle and a moped.

Pedelec are the only manufacturers confident enough to list all up weight in the specification - 36kgs, or 79.2lbs. The battery is carried behind the seat tube, just forward of the rear wheel. This leaves the integral, strongly made rear carrier completely clear. The motor, rated at 160W, is built right into the bottom bracket/chainset. The two heaviest components are thus located between the wheels, as low as possible, giving the Pedelec balance and a low centre of gravity for good handling. This intelligent

approach to the weight problem is followed through with a full suspension system: telescopic springs on the front forks, and a monoshock coil spring at the rear. Finally, hub brakes are fitted both front and rear. The net outcome is good handling, a comfortable ride, and real braking power: a proper machine.

But the thrill comes when you turn on the juice. Electric and pedal powers are channelled through a Sturmey Archer 3-speed hub. The Pedelec does not accelerate as quickly as a plain pedal bicycle, but once momentum is gained it rolls along very smartly. On level ground, electric alone sees a genuine 15mph. Adding a light trundle on the pedals sees 17mph, bending the cranks catches 22mph, and gung ho efforts send the speedo flickering past 30mph!

The Pedelec can be made to zoom, but don't be misled: in traffic, typical average speed is 11-12mph. A 6 mile journey takes half an hour. A bike will do as well or better. The important difference is that the Pedelec is literally less sweat: in conditions where on a bike you need only a shirt, on the Pedelec you need a jacket. You're working that less hard; exactly the formula your Elderly Relative is after.


There are limitations of course. On the short, steep hill where the Booster flamed out three times in succession, the Pedelec almost but not quite crested the summit before expiring. This was with the pedals going full tilt. For sure,

electrics don't like hills, and equally for sure, if the regulations permitted more powerful motors, the things could work properly.

The Pedelec came to us from another test, fitted with an optional child's seat, electronic speedo, and front and rear turn signal indicators. The child's seat was a wizard success with the small fry, who queued up for rides, and the turn signals meant that riders could keep hands on the controls. A 12V, 5W headlamp and 2.8W rear lamp are standard; the latter goes on automatically with the motor switch.

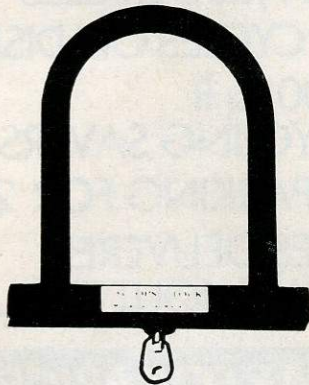
All in all, the Pedelec is a fine machine. It has limitations: at 80lbs the Elderly Relative isn't going to muscle it up or down stairs, and the machine itself won't cope with a stiff hill. But it is well designed and well made, and goes quite purposefully.

CONCLUSION: Government regulations restrict the power of electrically assisted pedal cycles, and most models cannot perform to a useful standard. Owing to bad design and/or building, particularly with reference to braking and handling, some models are grossly unsafe. The exception is the Pedelec Stella, which is well made, and which works. Not even the Pedelec however, can climb a stiff hill.

☆Prices shown are for basic models only. Carriers and other accessories cost extra. 

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