Improved dynamo charging for classic motorcycles

(with special reference to BSA's)

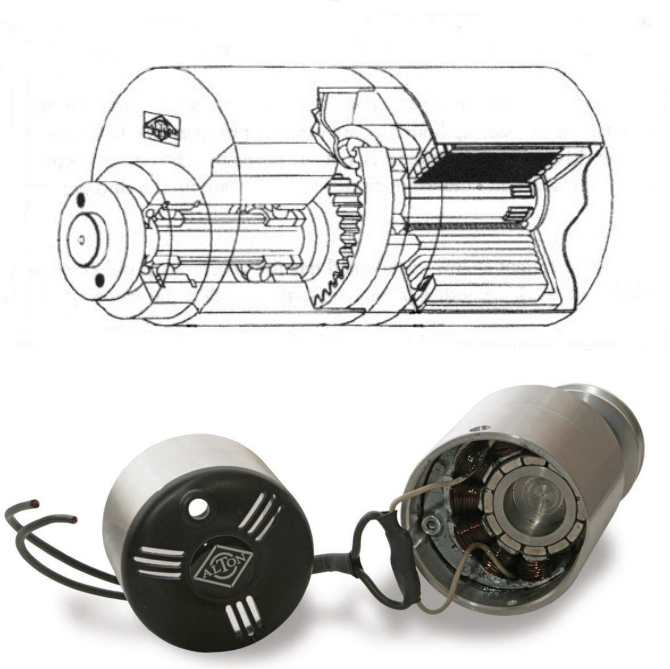
Today's riding conditions, it seems more often than not on congested roads, can expose the electrical weakness of our dynamo equipped machines. Present-day electrical demand may be increased by running with daytime lights and adding direction indicators in attempts to aid rider safety, or due to legal requirements (daytime riding lights being the norm in much of Europe and elsewhere). Electronic ignition to replace magneto ignition and higher Wattage lamps will also increase load. As an example the total power required to run a 60 W halogen headlight, or a 45 W main light with electronic ignition, and trickle charge to the battery will be about 85 Watts. More than the 60 W of the most powerful Lucas motorcycle dynamos!

A good number of products have been developed and introduced to the market over the years to try to improve the performance of dynamo based charging set-ups. The first step for many is to fit a modern electronic voltage regulator to replace the original electromechanical relay types. The latter are increasingly difficult to maintain and expertise is waning; new replacements are often very poor in quality and performance. Care is needed in selecting an electronic regulator as *they are definitely not all the same*. Cut-in speeds, build quality and reliability are among factors which vary enormously for the different makes available.

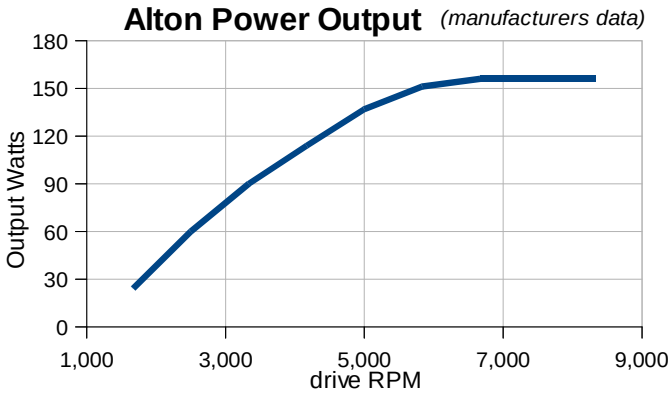
Rewinding the dynamo for 12 V output can be done. Also increasing dynamo drive speed ratio where feasible helps a standard '6V' dynamo to give good output at 12 V at lower revs. Several generator units incorporating a permanent magnet alternator in original dynamo sized case have been developed. How can classic riders, often with little electrical knowledge or experience, select the best improvements for themselves? This is sadly a market where extravagant claims are not always supported with clear data or established performance. So there follow here some actual numbers to provide a firmer basis for comparison.

Alternator Upgrade?

The most frequently encountered alternator upgrade is the French designed Alton unit, developed for the Vincent twin and sold as a modern higher output upgrade for many machines originally Lucas equipped. Headline claims are 150 W maximum output (at 6,000 RPM or more) with 85 Watts at 'moderate cruising speed' (3,000 rpm?) and zero maintenance. Prices for this alternator and regulator start at more than £400. The unit includes a pair of reduction gears to allow the offset E3 series drive (eccentric, 3 inch diameter) to drive the miniature permanent magnet alternator behind. This occupies well under half the volume of the unit.



Details regarding output against speed for current units has been sought but not provided by the manufacturers. The graph plots early data presented in an old article, but today's units are believed to be essentially similar in respect of Watts out against RPM. Note that the output is proportional to speed with claimed maximum only available at a rather high 5,000 RPM.



A number of versions of the Alton have been marketed but persistent reports of unreliability, especially of the internal gearing remain.

(Another alternator replacement is available from Powerdynamo of Germany as the generator part of their magdyno replacement. Their standalone E3L replacement unit appears to be no longer available, provided just 60 Watts output, as well as being rather costly.)

Fortunately the output and/or reliability of a dynamo generation system may be increased by attention to regulation and drive in the case of the BSA A7 and A10 twins.

Getting more from your dynamo

A well proven means to reliably increase the electrical power available on a practical bike is to stay with the standard E3L 6 Volt dynamo and fit it with a good electronic regulator set for 12 Volts. The DVR2 from DRL gives a precisely regulated voltage from lower RPM than most, if not all, of the other regulators available. The choice of regulator makes a very big difference in how well your battery charge stays up. Not all regulators are the same, and some take around 50% more revs to provide the same power output. But whatever regulator is used more revs will be required to get up to voltage compared with 6 V operation. With an E3L in good condition 6 A at 14 Volts (=84 Watts) is available at approximately 2,900 dynamo revs. Lucas specified the 60 W output as 8.5 Amps and 7 V at the low speed of 2,000 RPM. The maximum power is mainly limited by the heating effect of current in the armature windings, and 90 to 100 watts is a safe maximum loading in practice.

So the available output at common cruising speeds is pretty much the same as available form the Alton with the standard E3 dynamo in good condition and a DVR2 regulator.

(Note that the shorter E3H dynamo will provide greater power at 12 V using a DVR2 regulator but will be limited to safe maximum of 60 to 70 W.)

Converting a '6 V' dynamo for 12 V involves rewinding with more turns of thinner wire. This reduces the speed at which the dynamo gets up to voltage. The downside is that the thinner wire with its higher resistance limits the available current from the dynamo. Safe current will be just about half of the original unit, so the power output remains the same. And the thin wire leads to a more fragile unit.

On the A7/10 twins fitting a step up dynamo belt drive kit the engine speed at which power is at hand is reduced, by 20% in the case of the DRL kit. This is a quality kit with 15 mm wide high temperature toothed timing belt. Quiet in operation and low maintenance compared to a tiny chain in grease. Incidentally this 20% increase gives the same dynamo speed for a particular crank speed as on a magdyno machine, including a relatively high revving Gold Star. The table shows what this means in terms of the minimum road speed required to support the 84 Watt load (standard factory gearing is assumed).

Model	Crankshaft RPM for 30mph	Dynamo drive ratio	MPH for 2,900 RPM dynamo
A7	2,070	1.1	38
With DBDK	2,070	1.32	32
A10	1,750	1.1	45
With DBDK	1,750	1.32	38
B31	2,170	1.32	30
B33	1,940	1.32	34

Note: The 'DBDK' shown in the table is for where the DRL Dynamo Belt Drive Kit is fitted, and is not an obscure Gold Star variant.

What conclusions can be drawn?

- **Simple:** A standard equipment Lucas E3L '6 Volt' dynamo running at 12 V using a decent electronic regulator provides similar electrical power as the Alton replacement at typical everyday speeds in traffic, say 35 to 50 mph.
- **Superior:** On twins with a 20% increased speed belt drive to the dynamo load balance (zero on ammeter) with 85W load occurs at significantly lower road speed than with an Alton. A10 load balance is achieved at 38 MPH compared with 48 MPH. Clearly for sustained higher speeds a rider may benefit from the increased output from the Alton.
- **Dependable:** The simple Lucas E3L dynamo is widely reckoned to be remarkably robust and mechanically reliable. It is more often than not the bobbin type regulator that lets the charging system down. The armature is supported on two ball races, usually low maintenance sealed replacements on refurbished units these days. The only routine maintenance is the simple task of checking and cleaning the brushes and commutator once or twice a year. Spare parts are widely available when required and easy enough to fit. In contrast the rolling elements in the Alton are 3 ball races and a needle roller bearing. The latter also has gears which can be noisy and have given reliability issues. No user maintenance is possible.
- **Less expensive:** Finally the DVR2 costs £46 and the 20% up-geared strong no slip timing type drive belt is £78. It is an upgrade identical in external appearance to the original equipment.

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