REPAIRING THE STANDARD LUCAS RB106:

Dr. H Holden, Nov 2011.

Background:

The standard workshop manuals are basically good in terms of describing how to service and repair the original RB106, however there is not a lot of detail on how to physically do it to get the best results and good reliability. A description of the function of the RB106 is published in the first pages of the article on Experimental Electronic RB106's on the worldphaco.net website, so that will not be reproduced here.

This paper is a series of notes and photos on how to repair and get the best out of the original RB106. It also turns out that there is a common defect that most RB106 units have which is repairable. It will be shown that a significant improvement in voltage regulator contact longevity can be gained by adding a simple diode under the unit. In addition, reversal of the A and A1 terminals (in conjunction with a different regulator voltage setting than the manual specifies) is recommended to address battery charging issues.

When "the manual" is referred to this is Kenneth Ball's Auto-book 778 (TR4 Owners workshop manual).

The moving relay arms in the regulator are referred to as "armatures".

This paper is divided into six topics:

1) Finishing the contacts.

2) Repairing the common fault in the cut out armature.

3) Mechanical re assembly & mechanical adjustment.

4) Regulator contact protection.

5) A and A1 terminal reversal.

6) Electrical adjustment.

7) Additional technical information RB106.

1) FINISHING THE CONTACTS:

Any RB106 unit that has been used or has been kept in storage will have oxidation on its voltage regulator contacts and to a lesser extent on the cut-out contacts. The manual suggests cleaning the voltage regulator contacts with a fine carborundum stone or silicon carbide paper. A fine glass paper is suggested for the cut-out contact. To finish these contacts perfectly requires that the armatures that the contacts are fixed to be removed from the unit. This is done by removing the four 4BA securing screws. Before undoing the screws, and as you go, draw a diagram of how and in what order the various parts of the contacts and insulators stack together so that you re-assemble them the same way.

NOTE: The two brass adjustment screws with the springs, on the rear of the RB106 metal frame, are ELECTRICAL ADJUSTMENTS. These are not touched when doing the contact removal, cleaning and re-assembly. Once the contacts and the arms supporting them have been removed there is plenty of access to clean them and check them for damage. Figure 1 shows the 4BA screws and contacts removed:

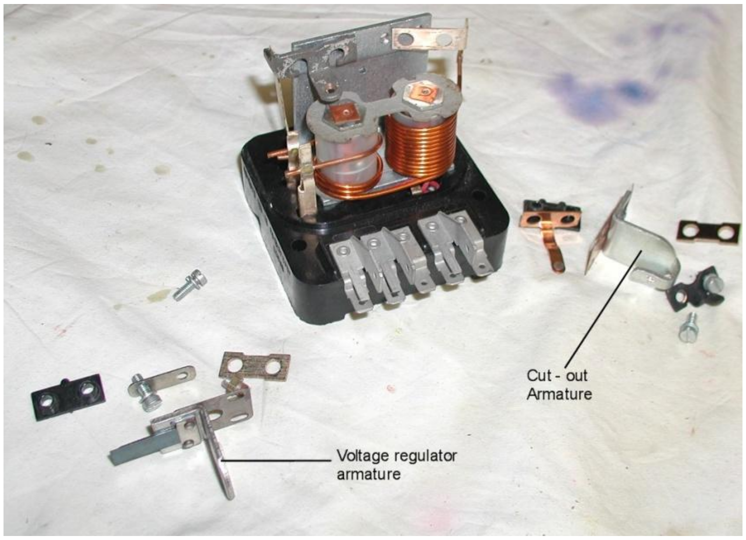

FIGURE 1.

Figure 2 below shows the voltage regulator contacts from a new old stock RB106. This is a fairly bad example with copious flaky whitish yellow oxides. Any oxide must be removed as oxides are generally electrical insulators. Used contacts have a black oxide and surface pitting.

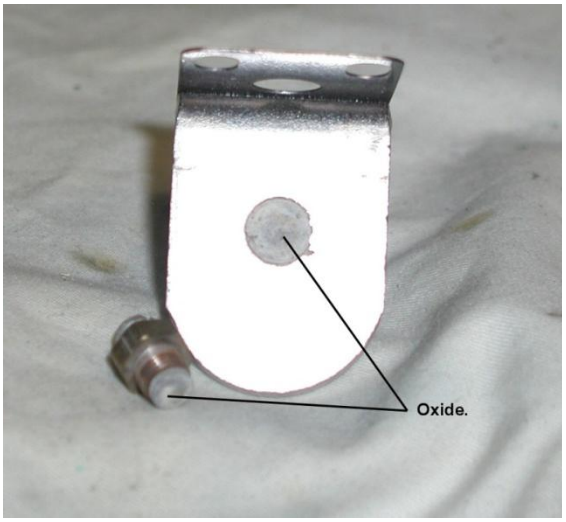

FIGURE 2.

The round screw contact can be held in the chuck of a drill press or lathe to spin it and clean it with 1000 then 2000 grade auto paper. It is best then to polish it to a bright shine with Brasso on a cloth or with a wadding polish, which is a mass of cloth like fibres with polish imbedded. The one I use is Eagle One, Never Dull, made by Eagle industries USA. The flat contact in the armature can be cleaned with the same papers. To clean a mildly oxidised contact, the abrasive paper can be wrapped around a flat object like a small flat file to support the paper and keep it flat. (Never actually file any contact). Again polish the contact. Figure 3 shows the contacts, which when polished should have a bright metallic shine:

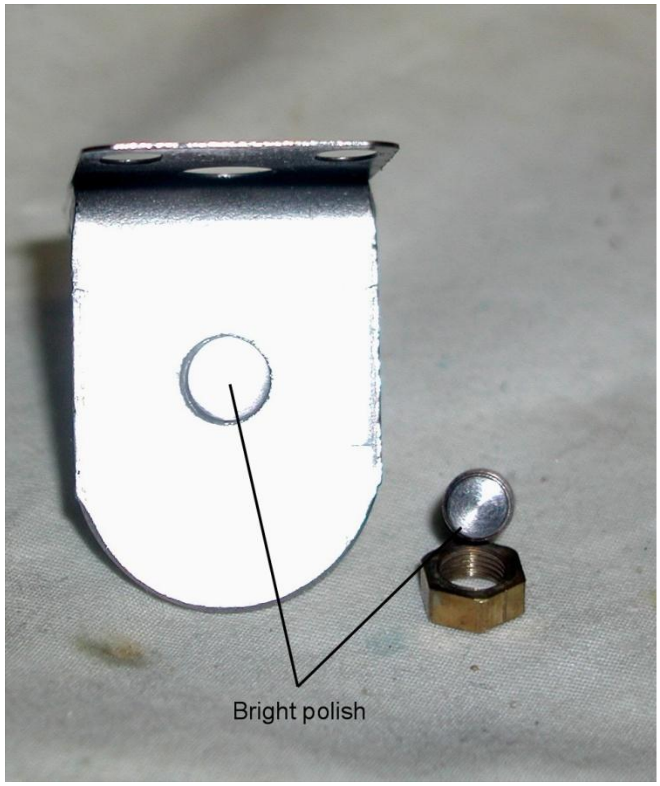

FIGURE 3.

The contact on the armature is usually flat and ideally its surface looks a lot like a mirror. The screw contact, unless badly worn has a conical or curved surface, so the surface area of mechanical and electrical contact is in fact very small despite the relatively large diameter of the armature contact. The voltage regulator contacts open and close at about 20 to 25 times per second (Hz) in use. In normal operation there is a destructive blue arc between the contacts which is corrosive to the contact metal and damages the surfaces, degrading both the electrical connection. Also dark soot like deposits collect in the area.

Figure 4 below shows some partially cleaned contacts where the pitting is visible.

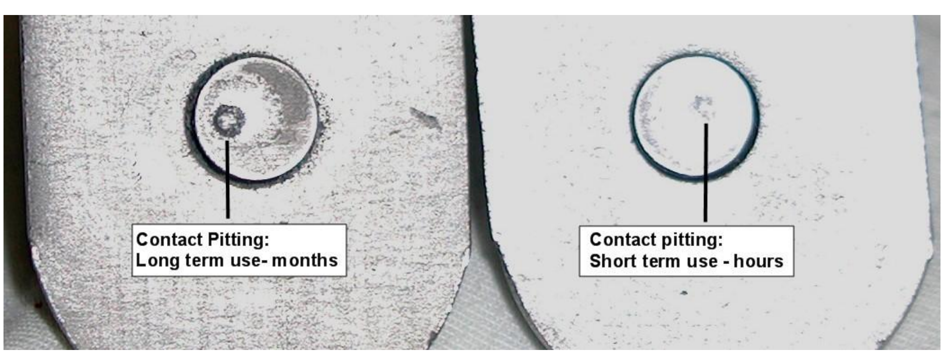

FIGURE 4.

It is possible to re-face a used voltage regulator contact that is badly pitted and burnt like the one on the left of figure 4 above. It must be done in a way that planes the contact down and leaves it with a perfectly flat face and then it must be polished. This can be done by using a rotating stone in a drill press as shown in the photo below in figure 5.The one shown here is from the Jaycar electronics Rotary tool kit part TD-2457. The armature is supported on one side of the drill press's support and the position of the rotating stone is shown in the sketch of figure 6. This way the armature stays flat and stable during this process, but still needs to be held firmly too. The contact is ground until the pitting just disappears. Then another stone is prepared with a 1000 grade auto paper disc glued to it (with Araldite or JB weld) figure 7. This is used to finish and polish the contact to a bright shine. The contact is very hard and as the 1000 grade paper wears down it progressively becomes finer and creates a bright polish. If there is mild pitting, just the 1000 grade paper covered stone will suffice.

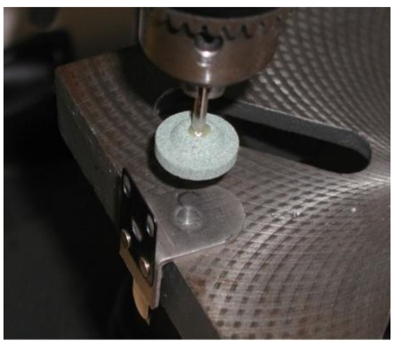

FIGURE 5.

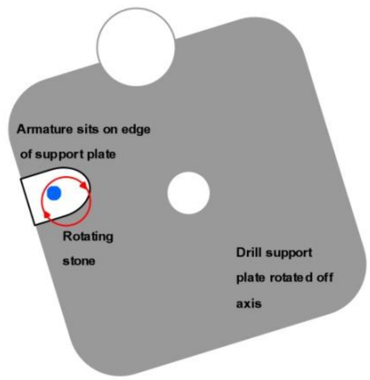

FIGURE 6.

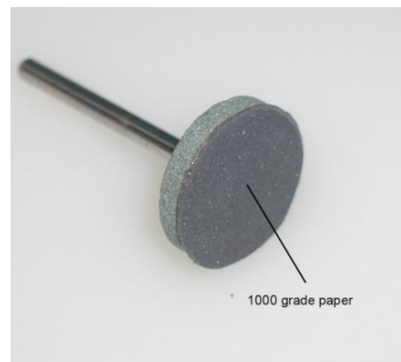

FIGURE 7.

Experiment shows that with a perfectly clean and polished contact it starts to burn immediately with use. After 10 minutes use there is a visible mark and after some hours use the damaging process is well under way. The problem is not so much due to the current the contact is carrying, but the fact that the field coils are an inductive load. When the contacts open the magnetic field of the dynamo's field coils and core collapses rapidly do produce a 60 to 100 volt negative spike or transient. The resistor in the unit helps to suppress (damp) this, but it is not perfect. The high voltage per meter electric field intensity in the narrow contact gap, at the point of contact opening, ionises the air between the contact surfaces and this creates the blue arc or plasma. Looking between the contact surfaces, the appearance is one of a miniature blue-white fire.

If you go to the trouble of finishing the contacts properly then the best thing is to avoid them getting burnt again. This is done by adding a single diode. The method to do this is describes in section 4 below.

The cut-out contacts are very easy to clean, merely with polish in most cases. 2000 grade paper could be used prior to polishing. These contacts are much softer, probably silver or a silver alloy unlike the tungsten voltage regulator contacts which are much harder. Be careful not to remove any excessive material and again never file them. Figure 8 shows the cleaned/polished contacts:

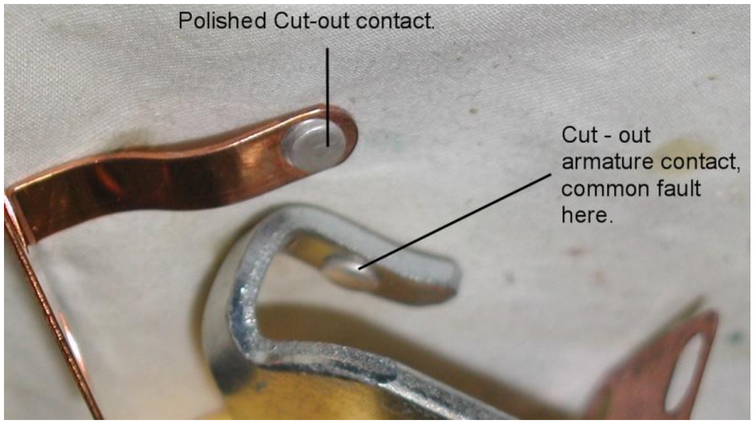

FIGURE 8.

2**) Repairing the common fault in the cut-out armature and contact bond:**

There is a common fault that I have found on at least 8 out of 10 RB106's in the cut out armature assembly. This fault can be in any unit regardless of age or manufacturing date. Resistance appears between the silver contact and the arm it is riveted into. At high currents, eg 20A, the voltage drop here can be as high as 0.2V in the faulty condition and the power loss around 4 watts. This causes significant heating of the armature around the contact. This will burn your finger tip when the current is high, eg headlamps on high, heater blower motor switched on and engine 2500 rpm and you won't be able to hold your finger on the top of the armature and contact very long. The other method to check it is to place a meter probe on the centre of the contact and one on the armature in the high output current condition as above. It should read 0.01v or less. In the ideal case, the voltage drop here at 20A load is only 0.001 to 0.002 volts. When faulty it will typically read anything from 0.02 to 0.2V.

The simple fix for this contact problem is to tighten up the riveted contact by tapping it with a small hammer and or flat punch while the opposite side of the contact is supported by a steel bar in a strong vice, figure 9. (The bar used in the photo was a spare lathe cutting tool).

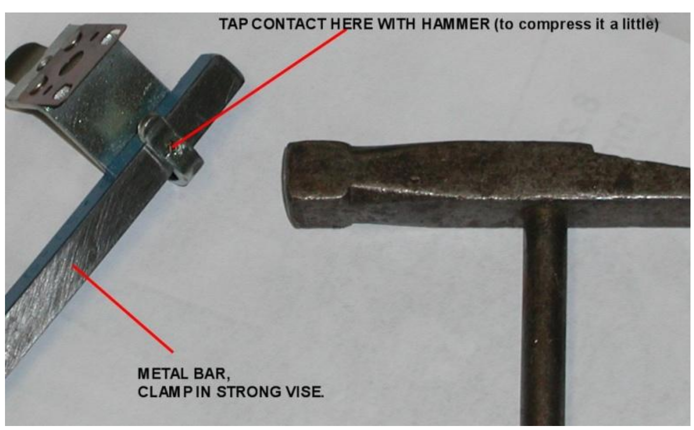

FIGURE 9.

However, after performing this treatment I have noticed with time and use of the regulator the resistance tends to reappear. In addition just tapping the contact to tighten it often only reduces the voltage drop at 20A load from 0.2V to 0.01V. When the connection is ideal it is only 0.001 to 0.002V. The contact is made of a “silver like” substance and the armature is plated steel. I’m not sure if it is zinc plated or cadmium plated. I suspect the latter. Oxides must build up between the surfaces of the two different metals, and despite pressure from the riveting process, there is still electrical resistance.

Seeking a definitive long lasting solution to this problem I have come up with the following procedure:

Firstly it requires the making of a simple tool to be able to remove the silver contact from the armature without damaging either. This can be made from a 10mm aluminium or brass bar with a 4.5mm diameter hole drilled in it a little off centre and filed down to about 7 mm tall. This acts as a support for the armature so the silver contact, which is a lot like a small rivet, can be pushed out of he armature, Figure 10 below shows a photo of this tool made from a 10mm square section of aluminium bar. The sizes are not critical:

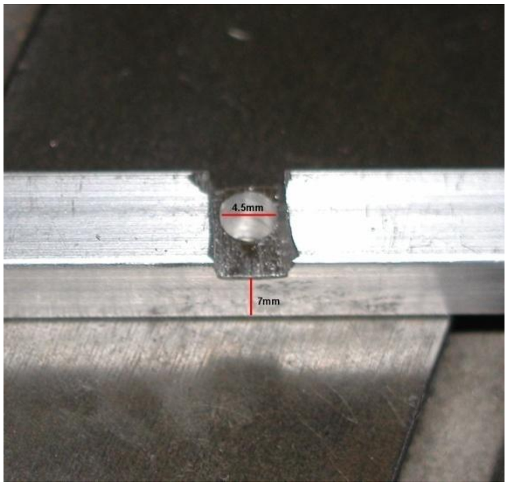

Figure 10.

This can be used with a couple of supports (wooden blocks will do) to hold the armature while the blunt end of a 2mm diameter drill can be used as a tool to press out the silver contact from the armature using the drill press as an aid, see figure 11 below:

FIGURE 11.

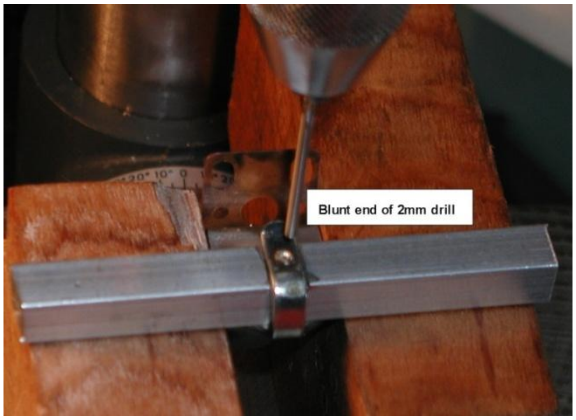

Figure 12 shows the pressed out contact:

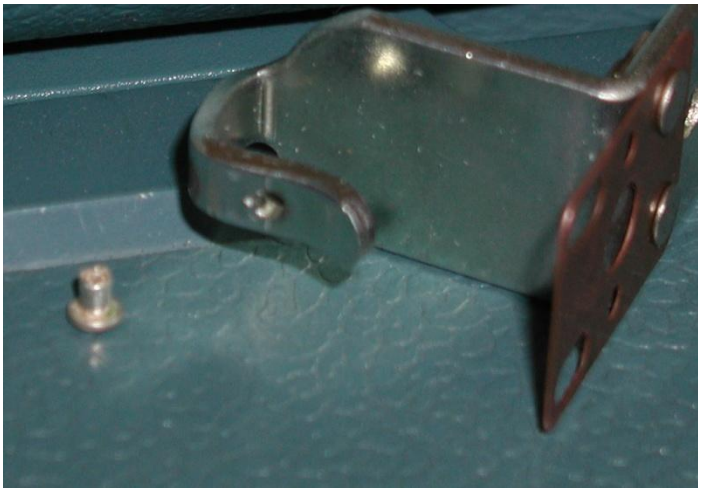

FIGURE 12.

Once the contact is pressed out the armature can be recessed a little (countersunk) with a 4mm diameter drill. Just enough to create a countersunk area of bare steel around where the contact projects when it is re-fitted. Figure 13 shows the general arrangement:

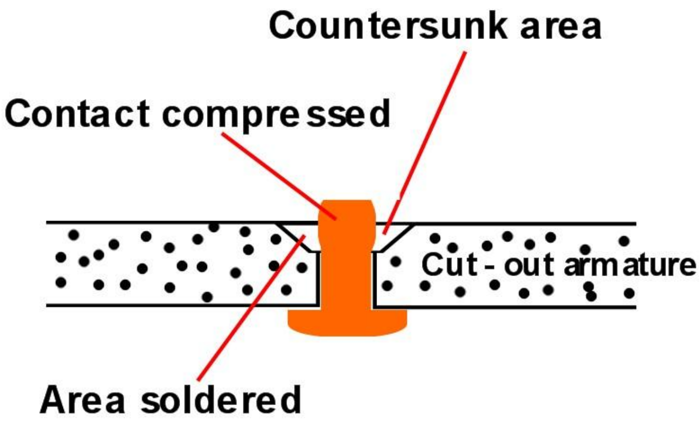

FIGURE 13.

One interesting thing is that the electroplating on the cut-out contact, even when bright and shiny, is resistant to soldering. However the countersunk drilled bare steel area in the armature is easy to solder to (with a small hot iron 450 deg C) as is the silver contact. After the armature is countersunk a little, the contact is re-fitted and compressed a little with a few hammer taps, as shown in figure 13. When it is back securely in place then the recessed area can be soldered to gain an excellent electrical connection. Figure 14 shows the contact re-fitted prior to soldering.

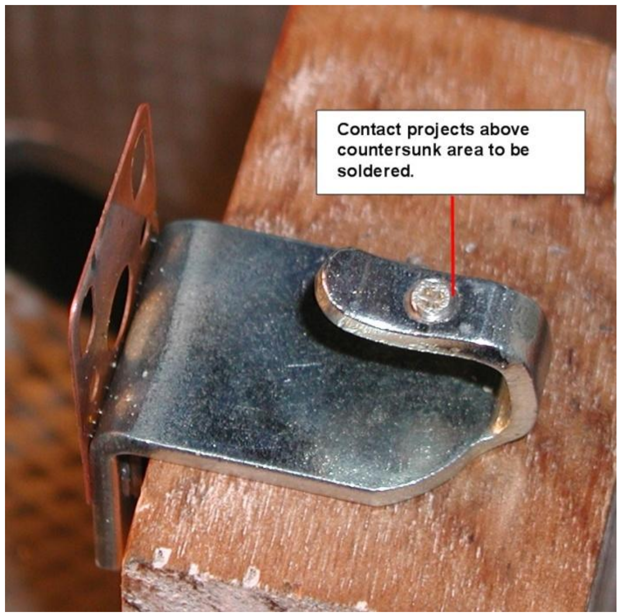

FIGURE 14.

Figure 15 below shows the appearance with the contact soldered. With the electroplating on the armature very resistant to soldering and the countersunk area and the contact are very easy to solder, the soldering takes on the neat appearance as shown in figure 15 where the solder adheres to the countersunk area:

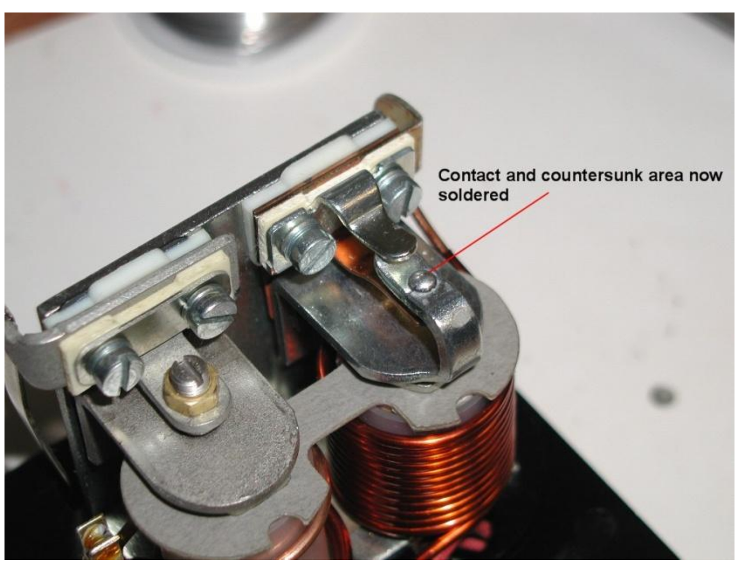

FIGURE 15.

With this contact dilemma fixed the voltage drop across the contact, when it is closed, even with 20A current is only in the order of 0.001 to 0.002 volts.

Some RB106's may require no attention to this cut-out contact, but that would be an exception in my experience. Some may just require compression of the contact to improve it that way, but it is bound to recur. Probably it is best to repair it as above with the soldering and avoid future problems.

3) Mechanical re-assembly and adjustment.

Assemble the cut -out first. With the two 4BA screws slack and everything in place (according to the notes you made when you disassembled it), press the cut-out armature *squarely down* on to the top of the copper segment on the top of the cut-out coil's core. While holding it firmly there, tighten the two screws up firmly, but don't use extreme force or the insulators can crack. This sets the correct position of the armature. Then while holding it down, check the gap between the upper most part of the armature and the small metal stop arm above it. This should be 0.8 mm with a feeler gauge. Bend the metal stop to set it. Finally adjust the copper arm (which carries the lower cut-out contact) so that with full depression of the armature towards its core, the contact is displaced about 0.4mm. This is done by bending the copper arm a little as required. This completes the cut out mechanical adjustment.

For the mechanical adjustment of the voltage regulator armature again start with the screws slackened. Some RB106's have a square shaped copper top on the coil's core, some round. For a square one use a 0.53mm feeler gauge, and a 0.38mm for the round type. Insert the feeler into the gap between the armature and the copper topped coil assembly and press down *squarely and firmly* and tighten up the two 4BA screws. This sets the position of the armature. While firmly pushing down on the armature (with the feeler still in place) screw in the round contact and locking nut. Adjust the screw contact until it just touches the contact on the armature. Tighten up the lock nut in this position. This concludes the mechanical adjustment of the voltage regulator contacts. The electrical setting adjustments were not altered but they will now be out of adjustment due to the re-setting of the mechanical adjustments.

4) VOLTAGE REGULATOR CONTACT PROTECTION.

The life and reliability of the contact can be greatly increased by adding a snubber diode across the field coil connection and earth. This clamps the -100V voltage transient to -0.7V and controls the field coil current when the contacts are open. This significantly reduces contact arcing and burning, not to zero, but to a very low level. A 6A10 diode is a robust option and a 1N5404 is also a suitable diode. Note that if the regulator is fitted to a positive ground car, this diode must be reversed.

Fitting a soldered in component, and soldering it properly, is as much about mechanical integrity as it is good soldering. The diode is firmly located prior to soldering. Make sure the F connection's silver plated brass strap is polished free of oxide prior to the soldering. The side clips on the lugs holding the two wires for the coils can be prised apart enough to slip in the diode anode lead then pinched back up again. The cathode lead is wrapped around the strap that connects to the F connection. This is shown in figure 15 below, prior to soldering the diode connections, and figure 16 after the soldering:

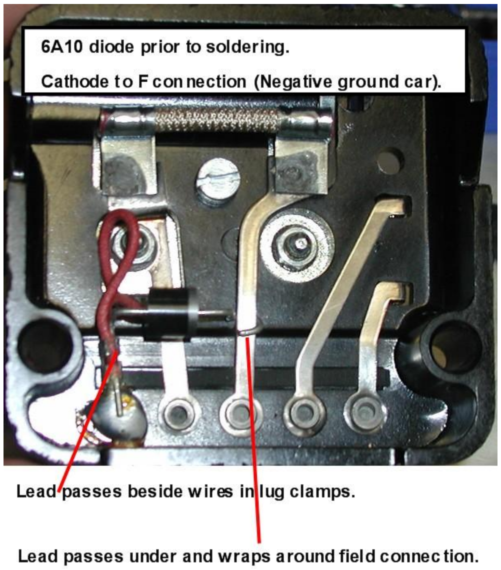

FIGURE 15.

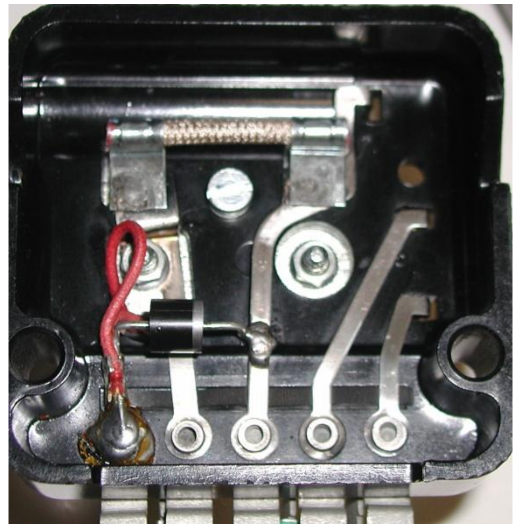

FIGURE 16.

5) A and A1 reversal.

This topic is presented prior to the electrical adjustment section, because if these are reversed a different regulator voltage setting (adjustment) is required.

I have pointed out on other articles that the setting of the RB106's output voltage is a compromise between excessive battery charge currents under low external loads(eg day driving) and undercharge under high external loads (night driving high beam headlamps). This is due to the fact that the voltage regulator(as it is called) is as much of a current limiter as it is a voltage regulator and the current coil's effect on output voltage occurs across the entire range of load currents from a very low current, up to 22 amps. In 3 bobbin regulators the current regulator cuts into operation at some specific high current value and inhibits the field coil drive at that value. For a 3 bobbin regulator, the independent signals from the detection of voltage and current reaching some threshold are OR'd together to inhibit the field coil drive, in that one signal, **or** the other, can do this *independently.*

On the other hand in the RB106, a "compensated regulator" the current signal, which is the magnetic field generated by the thick turns of wire around the voltage regulator bobbin, is **added** with that from the parallel coil sensing the voltage. So the voltage threshold at which the field coil is switched off is the sum of the two values to attain the threshold. This results in the output voltage from the unit sagging down proportionally to the current at a specific rate, in volts per amp, of voltage drop. The rate of drop is different for current taken from the A and A1 terminals. The voltage dropping effect with current loading is higher for current taken from the A1 terminal than the A terminal as there is an additional wire turn for the A1 terminal and this further adds to the magnetic field effect of the current altering the voltage regulator threshold. These features are summarised in the equation for the RB106 which I have presented in other papers. The original equation had coefficients of 0.13 for the A1 terminal and 0.08 for the A terminal.

Further testing suggests a coefficient of 0.14 might be a little more accurate. This is the result of the 3 turns of wire leading to the A1 terminal. The A connection has 2 turns so this terminals' effect is 2/3 as much or 0.14 x 2/3 = 0.093. For the initial equation I had settled on 0.08 for this value experimentally.

RB106 Equation: The voltage on the A and A1 terminals is Vout and T is the temperature in degrees C. This equation applies when the output voltage adjustment has been set per the manual at 16.0 V at 25 deg C and this is a revised or refined version:

$$\text{Vout} = 16.25 - \left(0.01\text{T} + 0.14\text{A}1 + 0.093\text{A}\right)$$

So for example at 25 degrees C with 4 amps via A to the battery and 10 amps via A1 to the external loads the regulator's output voltage will be 16.0 – (0.14 x 10 + 0.093 x 4) = 14.23V. The problem with this design is evident right away in that with low external load currents (via the A1 terminal) the output voltage is higher and this increases the battery charge currents, often to excessive levels, boiling away the battery's electrolyte, especially with day driving. At high load currents, the voltage drops significantly. For example with a 20A external load (headlamps on high beam & blower motor on) the voltage on the A and A1 terminals drops to 13.2 V and there is very little battery charging. It has been pointed out before that the ideal charging system is a constant voltage of 14.2V and perhaps with the negative temperature effect retained. So the ideal charging system is such that the voltage is not influenced by the current at all.

The graph in figure 11 (experimental data on a C40 dynamo & RB106) below is taken from the article on my Hybrid-Hall electronic regulator showing the standard RB106 (Red) and what happens if the owner inadvertently reverses the A and A1 terminals (blue), without making any voltage regulator adjustments. (Both the blue and red graphs can move up and down the Y axis with adjustment of the voltage regulator setting but retain the same slope).

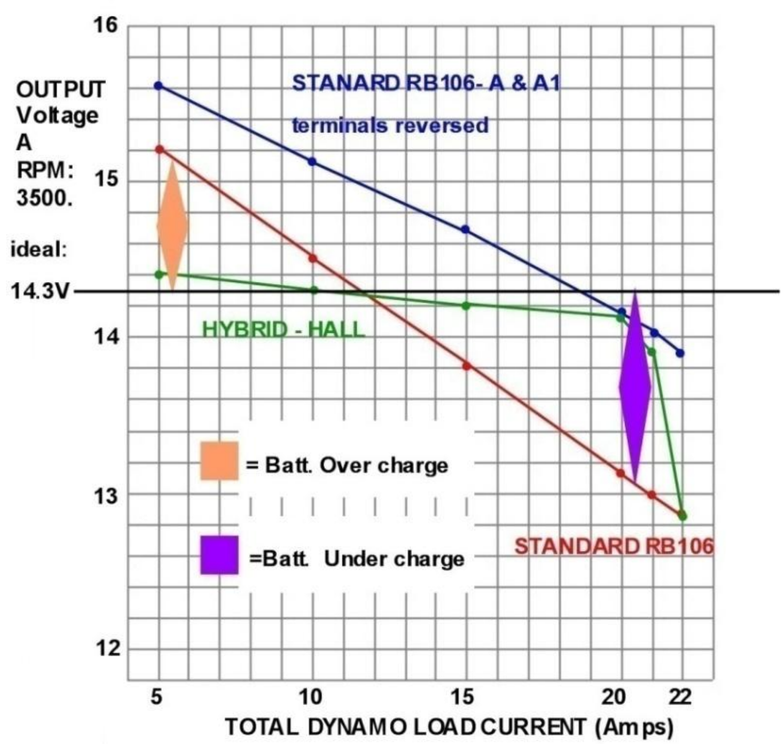

FIGURE 11.

In figure 11 the battery charge current was kept around 2A and load on the A1 terminal varied and the current measured and the voltage recorded. Looking at the red line (original RB106 and close to factory settings) the voltage drops from15.2V to about 12.85V over a range of 5 to 22A, or 2.35V/17A = 0.138 V/A, close to the 0.14 of the revised equation.

So the slope of the voltage reduction with the external loads being taken from the A1 terminal, as Lucas designed it, is approximately 0.14 Volts per amp.

As can be seen when the A1 and A terminals are reversed (ignoring the average voltage increase that could be adjusted out on the voltage regulator electrical setting) the slope is lower at around 0.09V/A. The original equation presented predicted 0.08 and the revised equation 0.093 V/A. The point being that the slope is lower by a factor of 2/3 for current taken from the A terminal compared to A1.

The inescapable conclusion is that the C40/RB106 system would be improved by reversing the A and A1 terminals. This results in better voltage stability with external loading and less battery over or undercharging with variability of the external load currents in the car, provided the voltage setting is reduced to a lower value than Lucas recommended.

So if the A and A1 connections were reversed, what should the new 25 degree voltage regulator setting be?

There is a simple way to work this out with the equation or graph. The voltage range over which the output varies from 0 to 22A (blue graph) is 0.093 x 22 = 2 volts and we want half of this above and below the 14.2 volt ideal level, then Vout = 14.2 – 1.0 = 13.2 volts @ 22A load and 14.2 + 1.0 = 15.2V off load. So 15.2V is the answer and this gives a range of voltage of +/- 1 volts around the ideal 14.2V level.

(Comparing the values with the unmodified system, a full load gives 12.92V, and off load 16V a range of +/- 1.5V around the 14.2V ideal level. The 2:3 ratio is no coincidence and simply relates to the turns of thick wire on the voltage regulator bobbin that connect to the A and A1 terminals)

Therefore if the A an A1 spade terminals are reversed as suggested here, the regulator setting at 25 degrees C should not be 16V as recommended in the manual, it must be reduced to 15.2V (15.0V is satisfactory see below)

The new regulator equation is still similar: for the A and A1 reversed condition, *battery connected to A1* and *external loads to A* for a regulator set for 15.2V at 25 degrees C:

$$\mathrm{Vout} = 15.45 - \left(0.01T + 0.14A1 + 0.093A\right)$$

Physical reversal of the terminals means plugging the brown/white wire (which leads to the ammeter & battery) on to terminal A1 and the brown/blue wire/s (which lead to the ignition switch & lights) onto terminal A in the TR4. So now we can see the advantage of this in that the external currents have far less effect on the output voltage and the battery charging currents. As can be seen at T = 25 deg C and zero A and A1 current the output voltage is 15.2V, which is the new *set voltage*. If you are setting the no load voltages at temperatures other than 25 degrees C the voltage to set it to is:

$$\mathrm{Vset} = 15.45 - 0.01T,$$ where T is the ambient temperature A and A1 reversed.

OR

Vset = 16.25 – 0.01T, Where T is the ambient temperature, A and A1 Standard.

(See section below on how to set the voltage regulator electrical adjustment below).

Results from the A1 and A reversal and the 15.2V open circuit setting:

Looking at the practical results of this new setting and reversed A & A1 terminals: Testing a RB106 in the test machine, the outcome looks good. A test regulator in the test machine shows that at 23.5A total dynamo output (1.5A to the field coils and 22A to external load on A1), battery charging is neutral (near zero) and there is 13 volts on A and A1. The expected voltage is 15.2 – 0.093 x 22 = 13.15V in fairly close agreement to the 13V measured.

At a low load current, dynamo output total = 5A. (0.8 A for the field), 4.2A load; of that charge current 1 amp and external load 3.2A, the measured output voltage was 14.6V on the A and A1 terminals. The equation predicts an output voltage of: 15.2 – 0.14 x 1 – 0.093 x 3.2 = 14.76, which is in fairly close agreement to the measured 14.6V.

Summary of A and A1 reversal:

By the mid to late 1960's it had been rightly concluded that the best way to charge a lead acid battery in a car was with the constant voltage method. The alternator voltage output settled upon by most manufacturers was in the range of 14.1 to 14.4 volts, typically 14.2V. The charging current therefore becomes a value equal to 14.2V less the battery's open circuit voltage, divided by the sum of the resistance of the wire connecting the generating unit to the battery and the battery's own internal resistance. Ultimately the charging current that the battery takes is inversely proportional to its state of charge. When fully charged, the charge current drops to less than an amp with this system. With a low state of charge, the charging current can be over 15 to 20 amps depending on the wiring and battery type. The voltage stability of the system is such that the generating and regulating unit (typically an alternator) will have a stable voltage regardless of current loading, typically only varying over the full load range from 50mV to 300mV, depending on the design. Certainly, for most systems, usually under half a volt variation is seen with the full current load range.

On the other hand, looking at the original RB106/C40 dynamo system, the voltage variation with the load range is 3 volts. This is the source of the high battery charging currents at low loads and the low or discharging battery currents at high loads. As pointed out before, this makes the voltage setting on the RB106 a compromise which cannot ideally satisfy both day and night driving. Reversal of the A and A1 terminals, going against Lucas's original design intentions, significantly ameliorates this problem and reduces the voltage variation from 3 volts to 2 volts over the full load range and still protects the dynamo from overload limiting the maximum current to 22A. In addition connecting the battery/ammeter circuit to the A1 terminal, rather than the A terminal, helps to limit the battery charging current to a 2/3 reduced value, which is helpful when the battery is very flat and the charge currents can be very high.

Why Lucas got this A and A1 connection "wrong" is not really a good question because their historical choice here is out of context with current knowledge, so it's a matter of conjecture. Suffice to say that at the time when the C40/RB106 system was designed, its origin dating back probably before the 1950's, the benefits of a charging system with a constant voltage and voltage stability with external current loading was not recognised as being too important. In addition their connection may have resulted from the compensated two bobbin regulator design compromises being taken to extremes. Their theory was that the battery's connection should have less compensation (the A terminal) than the external load connection (A1) so that the battery could pick up more charge during day driving to allow for the poorer night driving charging. This theory assumed an even balance between day and night driving and did not allow for mainly day or mainly night driving scenarios. So the day charging becomes excessive, boiling away the electrolyte. The high external current loading, eg headlamps & blower motor, with more compensation on the A1 terminal, causes larger fluctuations in voltage levels which are counterproductive to good battery charging.

6) ELECTRICAL ADJUSTMENTS.

There are two electrical adjustments. Figure 12 shows the location of the adjustments. The adjustments are best done with the regulator in the same orientation as it mounts in the car as gravitational force affects the armatures a little. When the adjustment is done in the car, as it usually is, this is not an issue.

Cut-out adjustment.

(A bit of a misnomer as this adjustment is done to set the voltage at which the cut-out relay *cuts in)*.

Connect a volt meter on to the D and E terminals of the RB106. Slowly increase the engine speed from idle and closely observe the cut out contacts. They should just close with the voltage close to or on 13V. At the moment after the contacts close the voltage drops a little and will give a false reading, so be sure to observe the voltage at the moment where they just close. Turning the screw clockwise will delay the cut-in to a higher voltage by increasing the return spring pressure on the cut-out armature.

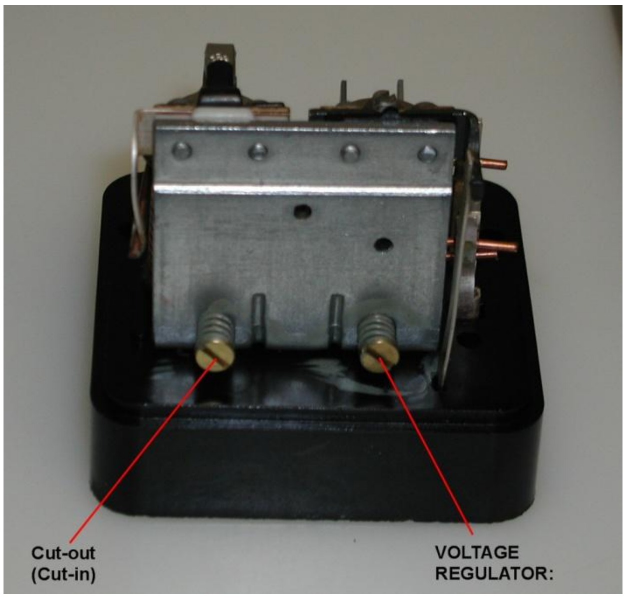

FIGURE 12 .

Voltage regulator adjustment:

This is performed in the open circuit condition. This means that the cut-in is inhibited. Place a small piece or cardboard under the cut-out armature to prevent it from closing its contacts. Then connect a volt meter between the D terminal and earth. Run the engine rpm at 2500. Adjust the voltage on the voltage regulator screw to the correct Vset (see below). This value depends on temperature.

For a standard RB106 with the original connections to the A and A1 terminals:

Vset = 16.25 – 0.01T (or 16V @ 25 deg C)

For the case where the A and A1 spade terminals are reversed (advised as a good modification in this paper):

Vset = 15.45 – 0.01T (or 15.0 to 15.2V @ 25 deg C)

Perform the settings of both the cut-in and the volt regulator as quickly as possible to avoid the effects of heating altering the settings.

Alternative method for setting the voltage regulator for either case above, TR4 must have standard electrical equipment:

A) Start with a car with a fully charged battery (battery on charge overnight).

B) Run the engine at 2500RPM

C) Turn on the heater blower and put headlamps on high beam (this corresponds to about 20A external load.

D) Adjust the voltage regulator setting for zero charge current on the car’s amp meter.

The alternative adjustment method above leads to an entirely new way of deciding what the set voltage should be, based on the required output voltage at the maximum dynamo output current. If we state that the maximum current will be 22A, and at that current the battery charging is neutral (near zero), then we could define this as an A and A1 output voltage of close the 13V with a fully charged battery. Therefore for a 25 degree setting example, in the standard RB106 system:

$$13 = Vset – 0.14 \times 22,$$

$$Vset = 16V, \text{ as per the manual.}$$

Or for the A1 and A reversed scenario:

$$13 = Vset – 0.093 \times 22$$

$$Vset = 15.04V$$

This 15.04V figure is close to the value of 15.2V calculated by bisecting the 2 volt voltage range around the ideal 14.2V figure as done above in section 5.

It will be obvious to the astute reader that a C40 dynamo and RB106 is such that with the current limited to 22A, the system cannot charge the battery to any great extent while providing this high output to external loads in the car. High beam headlamps and the blower motor combination push the load to just over 20A so the battery charging is minimal. The battery however is still reasonably well charged at normal beam & the blower on and even better at normal beam with the blower off. Also in the low load condition (eg day driving) and reversal of the A and A1 terminals and using the lower Vset (15V) as I have suggested here, means that the charging system’s voltage is lower than the original design. This reduces the battery’s overcharging with day driving and also helps to solve one of the major problems with the RB106.

The added diode helps solve the other problem of contact burn and contact longevity.

7) Additional technical information RB106.

Regulator out of the car:

Both the voltage regulator and cut-out coils have a DC resistance in the order of 100 to 120 Ohms. Since they are wired in parallel the electrical resistance recorded across the E and D terminals of the unit is around 50 to 60 ohms.

Measuring between the F connection and the D connection should be a short (low ohmic value) because the voltage regulator contacts are closed. Pressing the voltage regulator armature down (opening the contacts) then results in the field coil resistor being present between the D and F terminals and this should read around 60 Ohms.

With the regulator in the car, running at full current load (headlamps on high beam and heater blower motor on) the voltage drop from the D terminal to the A terminals should be around 0.2 to 0.24 volts maximum. About 0.04V of this is across the total structures of the cut-out contact assembly and about 0.16V of this is across the thick copper wire from the cut-out contact assembly to the A and A1 terminals.

Don’t forget to check for high resistance and voltage drop across the cut-out’s upper contact where it is riveted into the cut-out armature. The voltage across this area under full current load should be around 0.002V and certainly no more than 0.01V. In the common fault condition it can be as high as 0.2V and dissipating 4 watts of heat at a 20A load. See notes on this common fault in section 2 above.

H. HOLDEN, NOV 2011.

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