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Instrumental Note

A new lease of life for the Farmer-Baldwin dosimeter

B Vojnovic

Gray Laboratory, Cancer Research Campaign, Mount Vernon Hospital, Northwood, Middlesex HA6 2RN, England

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Replacement batteries for the widely used 'Farmer-Baldwin Sub-standard x-ray Dosimeter' (Farmer 1955), manufactured by Baldwin Industrial Controls, of Dartford, Kent, have become expensive and difficult to obtain, resulting in a number of such units being unnecessarily taken out of service. This note describes how the relatively simple addition of a DC-DC inverter can drastically reduce the maintenance costs of the instrument (MK2 version) by powering it from three commonly available 1.5 V cells, type U2 (IEC type R20). The function of the various controls on the instrument is not affected in any way.

The full circuit of the instrument is shown in figure 1, the DC-DC inverter being shown on the right half of the figure. In its original form, the electrometer integrator

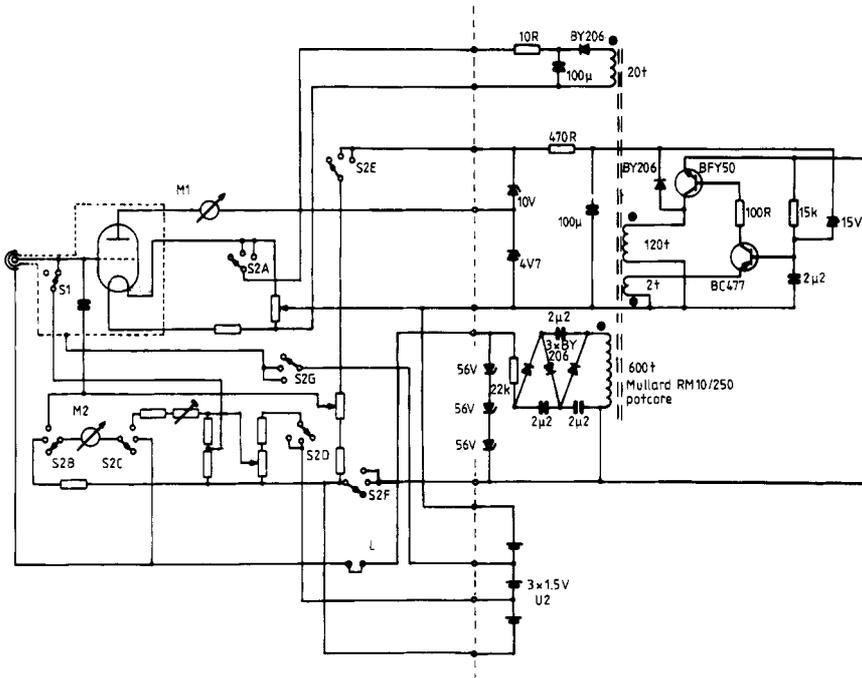


Figure 1. The DC-DC inverter circuit, shown on the right of the dotted line, is used to generate all the supply voltages required by the Farmer-Baldwin dose integrator, which is shown to the left of the dotted line. The transformer winding polarities must be as marked (dots show corresponding ends) for correct circuit operation.

requires seven voltage sources which are provided by two U2, six B123 and two 'grid bias' batteries. The present modification makes use of a flyback switching inverter, powered by a nominal 4.5 V. All the required voltages can be generated by combining the outputs of the inverter with those of the individual cells. The circuit is based on a design approach published by George (1979) and is particularly convenient as it generates directly +15 V from a -4.5 V supply. The pnp transistor (BC477) operates as a common base amplifier, with the 15 V Zener diode stabilising the output through the regulation of the base drive current. The inductively coupled flyback voltage spikes, generated as the transistors switch off, are used to charge the smoothing capacitors (100 μ F) for low voltage generation as well as providing the polarising voltage through a voltage-tripler circuit. Separate regulation of the polarising voltage is provided by the three 56 V Zener diodes. The oscillation frequency is approximately 12 kHz. The transformer is wound on a commonly available 'pot' core (Mullard type RM 10, RS Components 228-258) using 34 SWG wire for the low-voltage winding and 40 SWG wire for the high-voltage winding. With greater patience during winding (1500-2000 turns) the high-voltage circuitry could be further simplified by omitting the tripler circuit.

The inverter can be conveniently installed in the battery compartment of the dosimeter. The only modification to the circuit of the integrator involves the replacement of one pole of S2(F) by the permanent link L, such that S2(F) can be used as the inverter power switch. The power consumption is approximately 150 mW, so that a long battery life is obtained (days of continuous use, using alkaline cells, or many months of normal intermittent use). Three of the Gray Laboratory's dosimeters have been modified in this fashion and have been operating satisfactorily for ten months without any noticeable loss of accuracy. The component cost is less than £10.

References

- Farmer F T 1955 *A sub-standard X-ray dose meter*, *Br. J. Radiol.* **28** 304
George D 1979 *Electron. Des. News* **24** (11)