Maintaining constant colour temperature

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A common problem with tungsten lamps is that their colour temperature varies as the current through them is varied: the lower the current, the 'redder' the output spectrum. Operating the lamp at a constant current and placing variable neutral density filters in front of it is an option, albeit an expensive one. An alternative simple way is to use a rotating 'louver' type of attenuator, as shown in Figure 1. Simple trigonometry defines the relationship between transmission and angle θ of the louver, relative to the light source, as the dimensions p and m are varied:

Transmission $T = 1 - (W \sin\theta + T \cos\theta) / (l \cos\theta)$

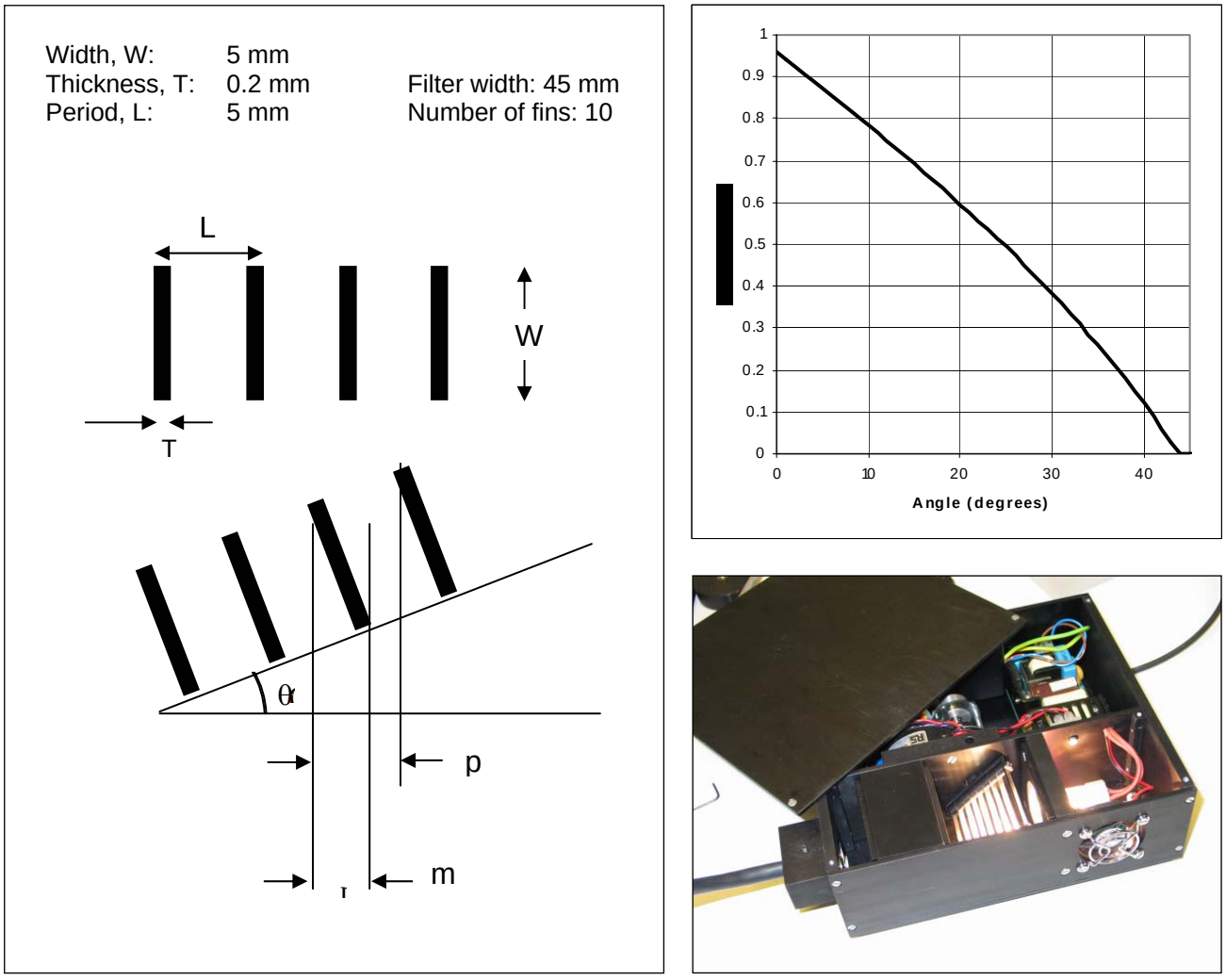

Figure 1: Using a louver attenuator over a 45 degree range allows control of light transmission from zero to nearly 95%, by using appropriate dimensions of the louver. A practical implementation is shown in the photograph: a lamp, power supply, servo control system and focusing lens to couple output light into a fibre bundle are all integrated into a single case.

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The way it is all put together is shown in the Figure 1, with the outline of the optics and control system shown in Figure 2. The servo system is the simple analogue device, described in the sections 'servo positioning systems' and 'useful circuits'. The result is a zero to +5V control signal in, mains in and variable light intensity out! Another feature incorporated in the design is a simple comparator, which senses when the control input is below some 50 mV and reduces the lamp current by 10%, reducing power dissipation and extending lamp life.

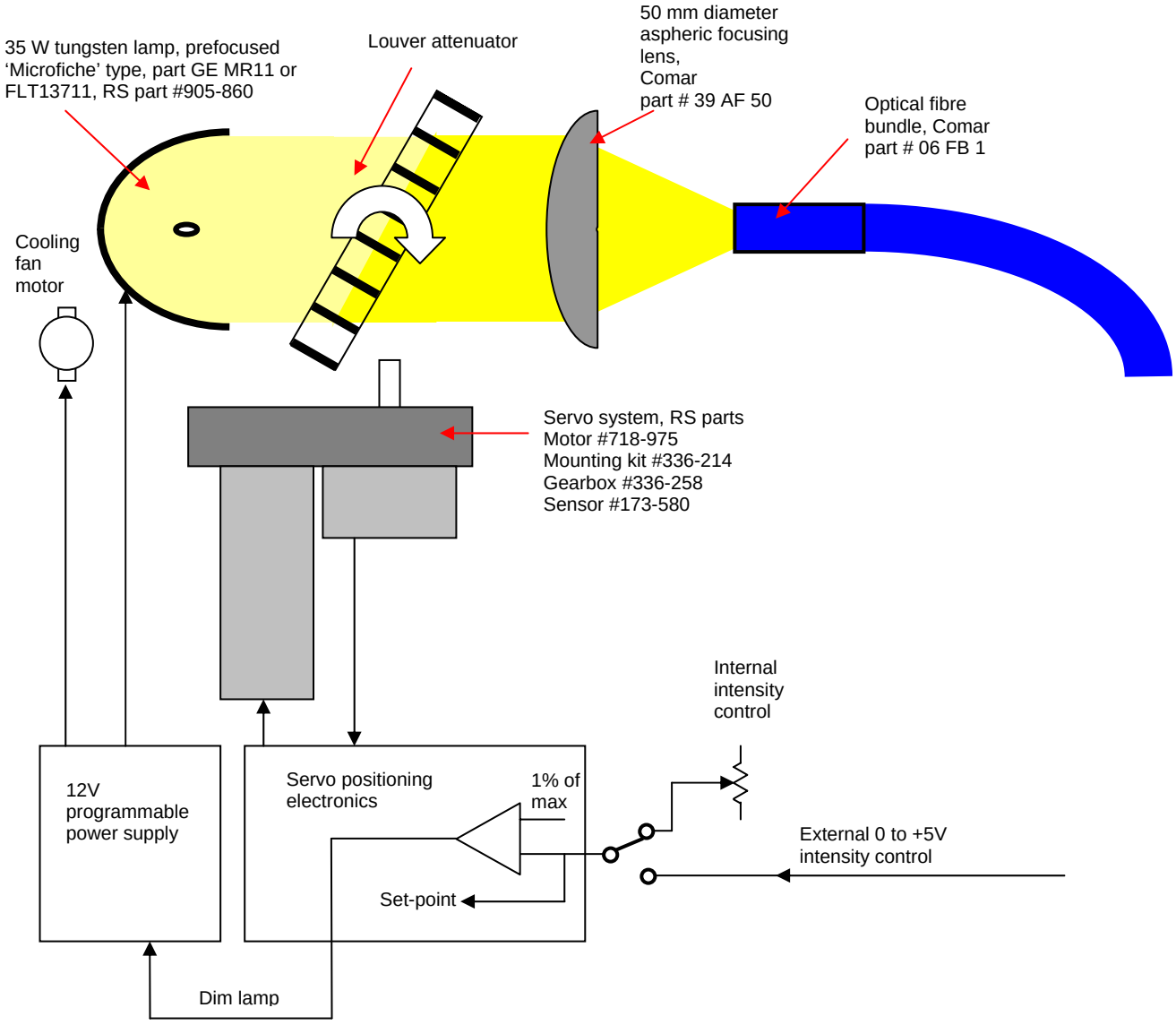

Figure 2: Optical and electrical arrangement used in the variable intensity light source

How did this project come to life? Credit must go to Professor Barry Michael, who many years ago, produced a metal comb when we were having difficulty in obtaining a wide range attenuator with a broad spectral range and capable of operation in high ionising radiation environments – at reasonable cost. All the best ideas are always simple…..

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