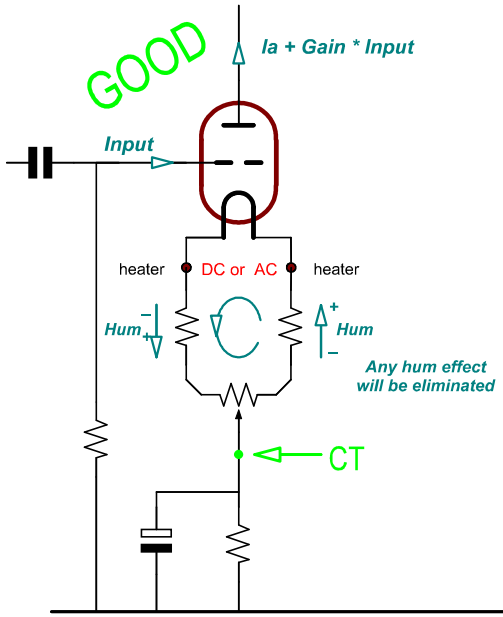
AutoBias

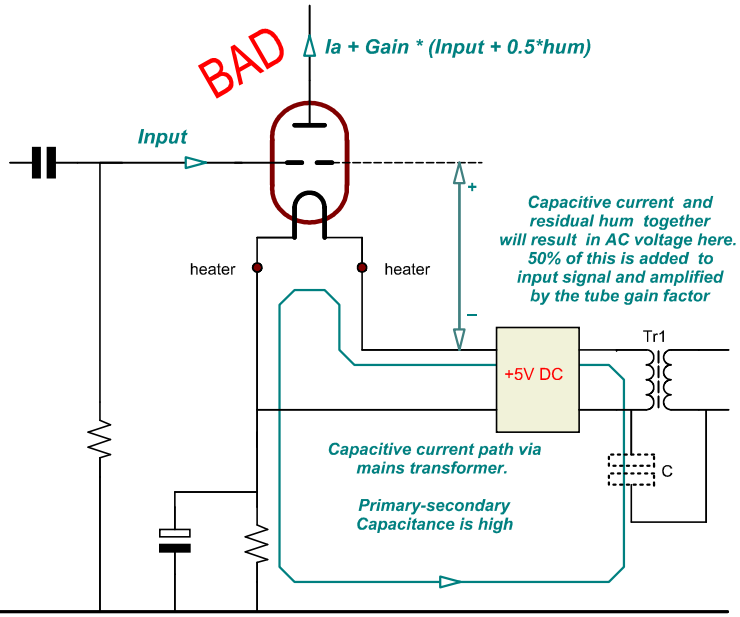
Classical Bias Scheme.
DC or AC heated
with optional balancing
pot meter



Wrong bias scheme for DC heating.
Problems are two:

1) Residual hum of power supply gets amplified by tube, because of asymmetrical circuit.

2) Capacitive Path, from mains transformer via heated module, will inject hum into the tube circuit.



PROBLEM: Amplifiers sometimes hum or buzz, with specific tubes. This so called "tube problem" follows the tube. In reality this is an amplifier problem. When you exchange the amplifier, the problem will "follow the amplifier". This design error is explained here, in some detail.

The classical bias scheme, with AC heating, is the best. It takes advantage of the natural capability of all DHT to reject heater hum, and capacitive transformer winding hum. What seems so "normal" is in fact a very difficult mechanism, where the grid field inside the DHT is split in to parts. For this, at first an artificial center tap is created outside the tube. It is called CT in the left picture. The center tap can be made simply with two resistors, or can be tuned even with a pot meter. In the end, CT will have half the voltage of the heater. This will split the AC heater voltage in two parts. For the Audio part, these are nothing but two huge HUM signals. One is on the left side of the grid field, inside the tube, one is on the right side. However these HUM fields are in 180° phase shift, eliminating each other. This is how classical AC heating works. It is often forgotten, that this also eliminates the capacitive current from the heater winding. This current is quite significant, and there is no way to avoid it. The classical bias scheme deals with this by itself. There is no need to worry about it. The circular path in the left drawing however shows this path, just for the interest. Since the two hum fields inside a practical tube, do not add up theoretically ideal, AC heating in a practical situation will give some small hum.

Today, low cost integrated circuits can supply DC heating, with an AC component in the millivolt range. If designers would just take the classical circuit on the left, it would benefit extremely from stabilized heating. All that is left, would be the capacitive current, and this becomes inaudible because of the two 180° phase shifted fields inside the tube, still doing their job.

However, it is often tried, not to use the centering resistors and more, mainly because their function is not fully understood. The circuit on the right appears... This is a bad circuit. The artificially created Center Tap is now gone. There are no longer two 180° phase shifted grid fields any more. Now there is just one grid field, and suddenly the capacitive current becomes a problem, as well as any residual AC voltage on the heater. Even worce, these signals are amplified by the tube gain, and appear on the anode as hum signal.

In a Push pull, or paralel Single Ended circuit, one may try to connect the tubes such that the error signal of the one tube is in antiphase with the other, but this is a poor attempt to save the balancing resistors that do a magnificent job ever since 1920 as this method was invented. Some hum or buzz may appear still.

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Revisions			Date	Name
Date	Name	Drawn	06.10.2012	JW

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Name:

Application Note AN07
How to bias DHT tubes without mistakes

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Drawing Nr.:

Page: 1 of 1