Subject: Fixed/cathode bias and AC
Posted by Manualblock on Tue, 19 Jul 2005 14:44:43 GMT
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Thanks all for doing a great job in explaining this.So fixed bias is derived from a voltage divider and a cap on the input AC signal. It has the advantage of allowing the tube to be operated at a fixed Vg.Self-bias uses a resistor to react to changes in the signal by following Ohm's law and causing a plate voltage drop to change with the Vg.The self-bias is self regulating and must operate in class A. It is easier to design due to the self-regulating properties of the circuit.AC component on the plate voltage is removed by the by-pass cap.Now why would anyone go to the trouble of using grid leak bias when they could just use the cathode bias? It seems so simple.

Subject: Re: Fixed/cathode bias and AC
Posted by Thermionic on Wed, 20 Jul 2005 05:26:06 GMT
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Howdy manualblock,A note here on grid leak bias. "Grid leak bias" and "grid bias" are different. Grid leak bias uses the time constant of a resistor and capacitor to charge and maintain a negative voltage on the grid. Grid bias, also called fixed or adjustable bias (no, there's no contradiction there, it just seems like it) uses an actively applied negative DC voltage on the control grid to set the operating point. It's called fixed because it's "fixed" and unchanging, completely independent of the tube's operation. It's called "adjustable" because the negative voltage can be varied to set the desired operating point.Cathode bias and grid bias each have advantages and disadvantages. Cathode bias takes away from the plate to cathode voltage, is higher distortion, is only truly practical for Class A operation, can create a lot of waste heat in certain instances, and yields less power than grid bias. But, most agree it's sweeter sounding, and as you mentioned is self-regulating. Some people will most definitely prefer the sound of one or the other, depending on personal tastes. By bypassing the cathode resistor, what you are actually doing is eliminating the effect of the AC signal on the cathode. Grid bias has a firmer sound, lower distortion, is easily adjustable, yields more power, and allows for full power output in Class AB operation. But, it adds complexity to the circuit with the necessary bias supply, and a failure of the bias supply will instantly cause the power tubes to go thermonuclear. Plus, the bias must of course be adjusted properly for best performance. Most all guitar amps are Class AB and high powered, so they're grid biased, and some audiophiles prefer the harder, cleaner sound of grid bias as well.Barring the phenomenon known as "rectification effect," if the stage is operating in true Class A, the signal has just about zero effect on the stage's current draw, since the tube never cuts off and the AC signal's average voltage is zero. The nominal current draw remains quite constant from idle to clipping. The plate current swings high and the plate voltage low on the positive alternation of the input signal. It's a positive voltage on the grid, which "neutralizes" the negative bias voltage, thereby reducing the bias and increasing conduction. On the negative alternation of the input signal, the negative signal voltage is added to the negative bias voltage to make the grid more negative. That of course increases the bias, thereby decreasing conduction, and making the plate current swing low and the plate voltage swing high. Here is Ohm's Law at work again, with the voltage going high with decreased current across the plate resistance, and

voltage swinging low with increased current across the plate resistance. An interesting phenomenon is that a Class A stage actually runs cooler at it's full, unclipped output than it does at idle. The actual amplified signal wattage goes into the load, so instead of burning up all that power as heat, it's subtracted from the waste heat.If the stage is biased so that it never goes into cutoff on the negative swing of the AC signal input cycle at the full, unclipped output, it is said to be Class A operating class. If the stage is biased so that it still conducts for appreciably more than 180 degrees before going into cutoff on the negative swing of the AC signal input cycle at the full, unclipped output, it is said to be Class AB operating class. If the stage is biased so that it conducts for exactly 180 degrees before going into cutoff on the negative swing of the AC signal input cycle at the full, unclipped output, it is said to be Class B operating class.Bias method and output stage topology are independent of operating class, and vice versa. You can have a grid biased Class A stage or a cathode biased Class AB stage, or a push pull Class A stage. You can have a single ended Class AB or Class B stage, although they're obviously not useful for audio because they don't amplify the full signal. They're used in radio transmitters.Thermionic

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Subject: Re: Fixed/cathode bias and AC
Posted by Manualblock on Wed, 20 Jul 2005 18:22:10 GMT
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Thanks Thermionic; This is really helpfull. Does the biasing scheme used, either Grid/cathode or grid leak have any appreciable sonic signature as you describe for triodes on a pentode PP amp? Any way you prefer to design a fixed bias circuit for triode PP amps? I ask because by observing your method then comparing it to another method I see more into the topic. It may seem redundant but it really brings home the message. I have schematics for the three biasing scheme's, are they pretty much universal in their application?

Subject: Re: Fixed/cathode bias and AC
Posted by Rek_O_Kut on Thu, 21 Jul 2005 17:02:00 GMT
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>The self-bias is self regulating and must operate in class A.Self-bias can be used for nearly any class of operation, including classes A, B and AB. In those classes for which the tube conducts less than 360 degrees, the time constant at the cathode must be sufficiently long to prevent the DC bias voltage from changing.

Subject: Re: Fixed/cathode bias and AC
Posted by Damir on Thu, 21 Jul 2005 18:51:07 GMT
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Hmm, cathode bias and class B? Zero (or very little) standing current, then rise to the max.? Even in class AB2 you have (more then) 1:2 current variations all the time, and in various tube books/manuals (RDH, for example) you can read that fixed bias is essential.

Subject: Re: Fixed/cathode bias and AC
Posted by Thermionic on Thu, 21 Jul 2005 23:51:44 GMT
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The ONLY place I know of cathode bias being used in a Class AB amp is in a very few certain guitar amps, and only then to net a certain, unique sound when the amp is cranked. But then again, I don't know everything.....But, even in that "special situation," the power tubes' operating point is still set pretty close to Class A to prevent it from completely "throwing water on the fire" when the amp is cranked.Thermionic

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Subject: Re: Fixed/cathode bias and AC
Posted by Forty2wo on Fri, 22 Jul 2005 02:54:22 GMT
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Now don't start that. we are. counting you to know everything:)I for one, read your post on 300b next door with great interest. I am not a mathematicin,(nor can spell one) but can work an example. Learn something with most of your post...John

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Subject: Re: Fixed/cathode bias and AC
Posted by Thermionic on Fri, 22 Jul 2005 17:34:57 GMT
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Oops! Sorry Forty2wo. It was Damir that posted on the technostuff of the 300B amp, not me. Although I do seriously get into that kinda stuff and luv it..... Thermionic

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