THE FIRST STEP : D.C.M.B. (I)

D.C.M.B. means **D**irect **C**oupling **M**odulated **B**ias .
It is a novel coupling system between valves , combining the features of the Loftin and White circuit with many more advantages that will be explained in detail . As every novel circuit , it requires some extra brain work to be fully understood and it requires personal listening experience to convince .

WHY D.C.M.B. ?

For over half a century , designers adopted , in most of their audio amplifier circuits , the capacitor / resistance coupling between one stage and the following .
This was made necessary because of the fact that the DC voltage present at the driving tube's anode had to be blocked . Otherwise , the same DC voltage would rush into the grid of the driven tube and cause damages .
The cap was sized to allow an acceptable range of frequencies to pass through it and this range , until some time ago (and often now) , was set between 20 and 20,000 cycles .
Not long ago , researchers demonstrated that a wider amplified range was beneficial to the quality of reproduction , especially at the high end . For some reason (opinions differ on the subject) frequencies beyond the human hearing threshold , when included , actively participate to shape the sonic personality of an audio reproduction device , giving it more brilliance .
Side experiments have given more credibility to this belief . Although apparently of different nature , the following experiment has something to do with it .
An amplifier was set to reproduce a low frequency , 40 Herz , as well as several of its harmonics (80 – 120 – 160 , etc.) . Then , electronically , the 40 Herz were removed and , although the spectrum analyser confirmed they were absent from the output signal to the speakers , still the human ear could notice its presence . In other words , the harmonics "testified" to the hearing sense , that , somewhere , their fundamental existed .
With the same logic , we can accept the fact that the inaudible sounds contribute to the timbre of the musical message .
Well , maybe yes , maybe no , but , why amputate the original stream , if we can avoid this questionable operation ?
Going back to our blocking caps , they really do a favour with their harmless connection (talking about DC) , but they really cost a lot in terms of quality of sound .
Our beloved musical message passes through them and , how do they treat him ?
They squeeze him and modify his personality .With the frequency discrimination they cause , the low frequencies' life becomes hard . Let us see how .
On the output side of these caps you regularly find the so-called grid leak resistor , whose value is chosen , usually , between 50 k and 500 k .
The cap has an internal resistance to AC , named reactance ; the formula is :-

$$Xc = 1 / (2 \times 3.14 \times f \times C)$$

Xc in ohms f = Herz C = Farads .

(Example : if we use a 0.22 µF blocking cap , the calculated reactance is 36.2 k-ohms at 20 cycles and just 36 ohms at 20,000 cycles) .
Supposing we have , at the exit end , a grid leak resistor of 100 k , the consequences are :

- In the first case , at 20 Hz , over one third of the signal's amplitude is "eaten" by the cap and the grid leak resistor gets only 73 % ,
- In the second case , the signal crosses undisturbed .

The voltage amplitude measured across the grid leak resistor is what the output tube gets as driving signal . The unfair behaviour of a cap with respect to low frequencies becomes obvious .

The caps can be of excellent quality , still , they all have some kinds of internal vices that disturb the purity of the musical message (foil , dielectric , etc.) .

Many authors state that even the most expensive , hi-quality, cap is worse than no cap at all.

DCMB belongs to the well known DC coupling family , honest and straightforward , but it has some properties that make it the farthest step in the field .

Consider the main dilemmas we have to face :-

1. We want to hand over , to the following tube's grid and cathode , the voltage swing that the driver's gain has built across its anode load, and we want to do that instantly and without any kind of fee ,
2. We want to prevent the DC , present at this load resistor's terminals , to force its way through the grid of the next tube , damaging it .
3. We do not want any capacitor's interference , such as discrimination between frequencies and generation of phase shifts .

DCMB matches the above three requirements , without unbearable compromises .

The enclosed schematics and their text will illustrate how this result is achieved .With this novel layout we are going to buy a better quality, paying for it just the price it deserves.

Someone could find beforehand the statement of better quality questionable . I would be surprised if this attitude still remained after self experience in building or listening .

As stated above , we will have to give something in return and admit that the blocking condenser system is quite safe and handy .

No doubt many of the readers are happy with the simple and efficient cap / res. coupling , and prefer to stick to it . I respect their choice . However , I am sure that some others seek for quality improvement . Their ambitions will materialize with DCMB .

Equal gain on a wider frequency band , faster handling of transients (dynamics) , much lower phase shift , etc. are a promise that will be kept , provided design and construction respect the rules.

Some additional positive points will be discovered , amongst which :-

- improved damping effect in the output tube's operation , mainly because DCMB eliminates the need for a fixed bias resistor that burns , in addition , a lot of energy .
- versatility , because it can be adapted to many output tubes , with minor adjustments.
- Economy , considering the cost of hi-quality caps , worth a bottle of Champaign each.

I will not neglect to mention , to be fair , the negative points I am aware of , and I will give the solutions I found to neutralize them , based on my 5 year experience on the subject, encompassing dozens of drivers of this kind and over ten completed amplifiers (P-P , S.E. and SEPP) .

DCMB deserves to be tried ! The more we are to look at it , the faster this novel system will improve and expand , helping other friends to enjoy their favourite melodies in the best way.

Ari Polisois

April 2002

(*) not surprising that the formula of the phase angle includes capacity and resistance , namely :

$$\text{Phase angle} = \tan^{-1} \times (Xc / R) \quad ,$$

when the cap and the resistor are in series , predominantly our case) .