電池電源を超える、第2世代シリーズ電源モジュール
Development of Second Generation Series Power Supply Module Exceeding Battery-operated Power Supply

Abstract:
From the Fourier Analysis, by making analysis and arrangement of circuit constant of the Second Generation Series Power Supply which I have made technological announcement to AES2005, I have succeeded in the development of Power Supply Module which turns out to be ideal DC Power Supply with lower impedance exceeding battery-operated DC power supply.

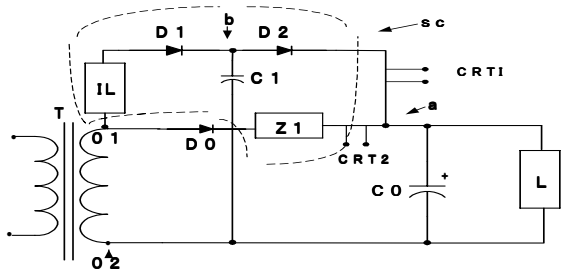
Current Problem:
There exist critical defects in the capacitor circuit developed in the early part of 1900 as audio power supply. When shifting from capacitor to Di, the following two phenomena are observed:

1. As the voltage on Di is gradually risen only, high current does not flow immediately.
2. From the two phenomena in which high current flows into the capacitor after discharging (transient phenomenon, starting from short-circuit condition), no supply to load current is made, causing occurrence of loss phenomenon.

These phenomena produce two critical results:

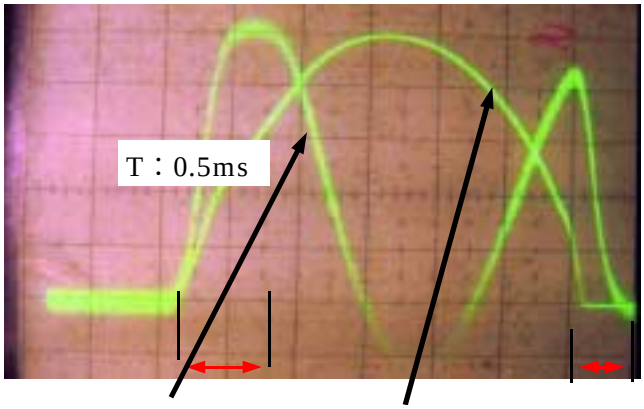
1. As internal impedance of the capacitor on an off-state condition rises, Di rectification current suddenly flows to loads, which causes occurrence of noises in rectification circuit itself (pay attention to p-p noise level of Fourier Analysis. It is unable to reproduce harmonics spectrum).
2. The function of amplifier stops dead due to supply loss of load current and abnormal noise is reproduced due to generating loss in audio-frequency(voice) signal (approx. 10%/cycle). (Loss of supply power makes woofer driving incorrect, and loss in voice signal , when connected, makes voice intense.)

Solutions to Problem:
The second Generation Series Power Supply (Degawa-style Power Supply) is to solve supply loss of load current, by rectifying with another sub-rectification circuit at supply loss time zone of load current, by keeping floating electric charge to capacitor, by making starting time difference between main rectification circuit and sub-rectification circuit, and by putting the floating electric charge into main capacitor within that time (Patent pending).
Please refer to Degawa-style Power Supply at Yahoo for customer's experiment results



Function of Sub-Rectifying Circuit (SC):

To complement carriers of short-circuit time zone of recharging C0 at start time of Di rectifying current in main rectifying circuit, sub-rectifying circuit (SC) is required as essential condition to delay time to transfer the carriers from C1 to C0, and also to delay start time of rectification in sub-rectifying D1 (Capacitor is capable of discharging right at the start of recharging.).



D2,Rectifying Waveform D0,Rectifying Waveform

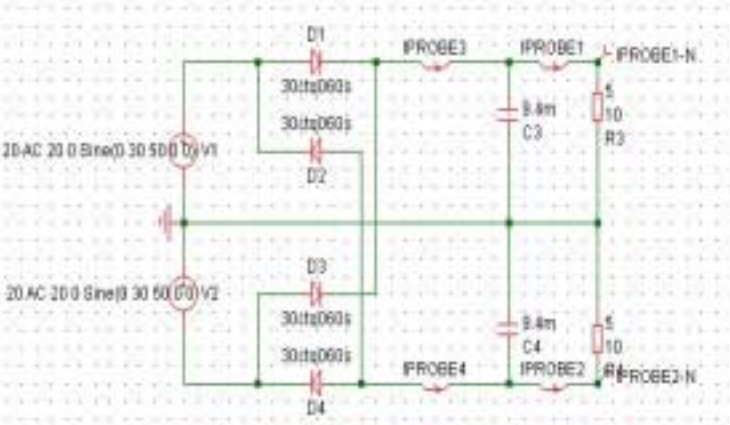
Waveform Actually Measured

Rectifying Waveform D2 is the current waveform flowing from C1 into short-circuit condition of C0 at rectification start time of D0. Paradoxically, without this, load current does not function during the time when rectifying current of D0 flows into C0 with short-circuit condition for this area.

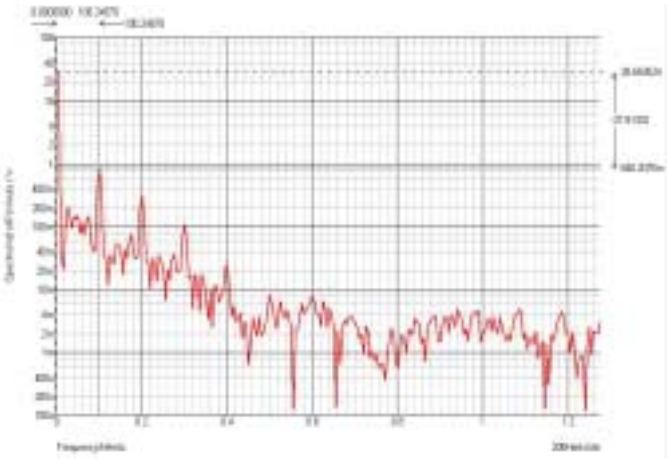
Fourier Analysis
The 1st、2 nd generation of power supply circuit

To verify the difference between the conventional series power supply and 2nd generation power supply, I have paid attention to the noise level generated due to the loss in the current between ripple and ripple P-P.

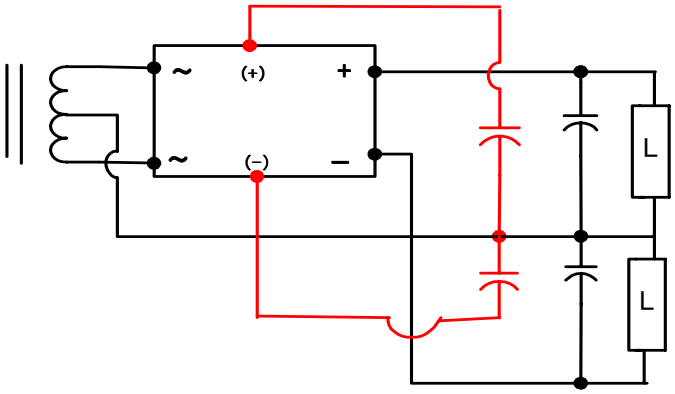
1st generation series power supply circuit



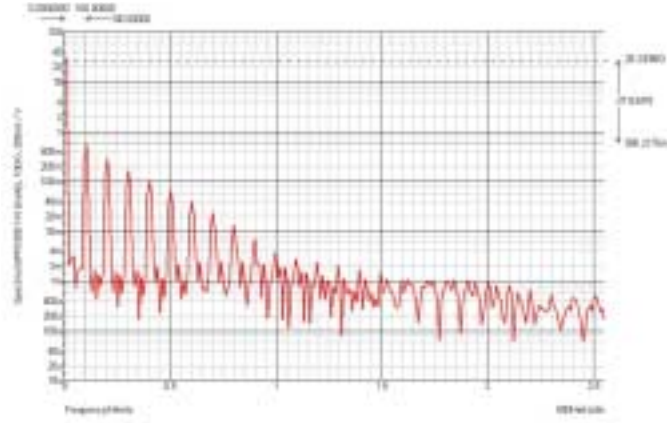
1st PsVoutSpec.jpg : Vout+1 spectrum



2nd generation of power supply circuit



2nd PsVoutSpec.jpg : Vout+1 spectrum



Explanation
1stPsVoutSpec.jpg : Vout+1 Spectrum　2ndPsVoutSpec.jpg : Vout+1Spectrum

As a result of CP simulation, I have discovered occurrence of abnormal noise due to current loss between ripple P and P at the spectrum. In the conventional capacitor input power supply, the P to P noise level at the spectrum less than 100Hz shows 200mV. Whereas in the 2nd generation power supply, by optimizing the capacitor in the auxiliary circuit of 2nd generation power supply,
the noise level drops to 1mV. In the conventional power supply, the noise level between ripple P to P and ripple Peak is not identifiable at the spectrum over 400Hz. Due to generation of the noise caused by the current loss, even if the fundamental tone of the audio-frequency signal is reproduced by amplifier, it is mixed with the noise at high frequency spectrum, and is impossible to separate the harmonics of a fundemental tone in theory. Therefore, it is impossible to reproduce the harmonics of a fundamental tone (natural tone) at high frequency spectrum. On the other hand,
the second generation power supply makes it possible to accurately separate the noise level from ripple P up to 2.5KHz. It proves that there is no current loss between ripple P and P.

Conclusion

This work was supported by converting all power supplies for audio system (CD, pre-amplifier, main amplifier) to the second generation series power supply enables to improve high frequency distortions in power supply circuit and to reproduce all of the lost audio-frequency signals, and also it enables to reproduce the harmonics of a fundamental tone (natural tone) and Hall tone.
Using for digital circuit power supply such as DA converter enables to reproduce accurate digital waveform and to improve brightness and resolution of digital image.