power supply. A further need exists for a power supply that can reduce the need for large components and thus be made small in size and profile and lightweight.

SUMMARY OF THE INVENTION

[0013] According to one or more embodiments~~In one aspect~~, a power supply is provided in which one or more input waveforms are shaped or otherwise selected so that the output waveform requires minimal smoothing for generation of a DC output waveform.

[0014] According to one or more embodiments, a power supply is provided having one or more input waveforms are shaped or otherwise selected prior to being provided to an isolating transformer. The nature of the input waveforms is shaped or selected so that the transformed waveform requires no or minimal smoothing for generation of a DC output waveform.

[0015] The power supply may comprise a waveform generator, a level conversion stage for stepping the voltage level up (or down), a rectification stage, and a signal combiner. The waveform generator may generate complementary waveforms, such that after each of the complementary waveforms is rectified and combined their sum will be constant, thus requiring no or minimal smoothing for generation of a DC output waveform.

[0016] In one embodiment, a DC output power supply comprises a waveform generator, at least one transformer, a rectification stage, and a signal combiner. The waveform generator may generate complementary waveforms, such that after each of the complementary waveforms is rectified and combined their sum will be constant. The complementary waveforms are preferably identical but are 90-degrees out of phase from one another, although in other embodiments the waveforms may have a different relationship. The complementary waveforms are applied to a pair of transformers or a

single transformer with separate windings. The outputs of the transformers are provided to the rectification stage, which outputs a pair of rectified signals. The rectified signals have the property that when added together, their sum is constant. The rectified signals are provided to the signal combiner, which sums the signals and produces a constant DC output signal.

[0017] In certain embodiments, the output voltage is monitored and fed back to the input side of the power supply, which adjusts the amplitude or other characteristics of the complementary waveform signals prior to being applied to the transformer(s).

[0018] In other embodiments, a switched-capacitor technique is used to adjust (e.g., step up) the voltage level of the complementary waveforms, instead of transformer(s). In other respects, the power supply operates in a similar fashion.

[0019] Embodiments as described herein may result in one or more advantages, including being smaller, lighter, thinner and/or less expensive than a conventional power supply, with fewer large components, while retaining high efficiency. The power supply can be designed so as to produce minimal or insignificant EMI. Because the power supply can be simpler to design and manufacture, it can be brought to market more quickly, thus resulting in a faster product design cycle.

[0019a] According to a first aspect, there is provided a power supply, comprising: a waveform generator outputting a first waveform and a second waveform; a first rectification stage coupled to said first waveform, said first rectification stage outputting a first rectified signal; a second rectification stage coupled to said second waveform, said second rectification stage outputting a second rectified signal, wherein a sum of said first rectified signal and said second rectified signal equals a substantially constant value; and a DC output signal having a level at said substantially constant value formed by continuously additively combining said first rectified signal and said second rectified signal.

[0019b] According to a second aspect, there is provided a power supply, comprising: a waveform generator outputting a first waveform and a second waveform; a first transformer receiving said first waveform as an input; a second transformer receiving said second waveform as an input; a first rectification bridge coupled to an output of said first transformer, said first rectification bridge outputting a first rectified signal; a second rectification bridge coupled to an output of said second transformer, said second rectification bridge outputting a second rectified signal; and a DC output signal formed by continuously additively combining said first rectified signal and said second rectified signal; wherein a sum of the first rectified signal and the second rectified signal equals a level of said DC output signal; and wherein both the first rectified signal and the second rectified signal are non-zero simultaneously and, during those times, contribute additively to the level of said DC output signal.

[0019c] According to a third aspect, there is provided a method for power conversion, comprising: generating a first alternating waveform and a second alternating waveform; rectifying the first and second alternating waveforms to generate a first rectified signal and a second rectified signal respectively, wherein a sum of said first rectified signal and said second rectified signal at any instant in time equals a substantially constant value; and forming a DC output signal at said substantially constant value by continuously additively combining said first rectified signal and said second rectified signal.

[0019d] According to a fourth aspect, there is provided a power supply, comprising: a waveform generator outputting a plurality of input waveforms; a plurality of rectification stages, each adapted to receive one of said waveforms and output a corresponding rectified signal, thereby forming a plurality of rectified signals; and a DC output signal formed by continuously additively combining said plurality of rectified signals.

[0019e] According to a fifth aspect, there is provided a power conversion apparatus, comprising: a waveform generator operative to output a first time-varying waveform signal and a second time-varying waveform signal; a first rectification stage coupled to said waveform generator, said first rectification stage operative to output a first full-wave rectified signal in response to said first timevarying waveform signal; a second rectification stage coupled to said waveform generator, said second rectification stage operative to output a second full-wave rectified signal in response to second time-varying waveform signal; and a summing circuit coupled to said first rectification stage and to said second rectification stage, said summing circuit operative to form a DC output signal by continuously summing said first full-wave rectified signal and said second full-wave rectified signal; wherein a sum of the first full-wave rectified signal and the second full-wave rectified signal equals a level of said DC output signal; and wherein both of the first full-wave rectified signal and the second full-wave rectified signal, when non-zero, simultaneously contribute additively to the level of said DC output signal.

[0020] Further embodiments, alternatives and variations are also described herein or illustrated in the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a conceptual block diagram of a DC output power supply as disclosed herein, using one or more transformers for signal level conversion.