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PHASE LAYERING APPARATUS AND METHOD FOR A COMPLETE AUDIO SIGNAL

ABSTRACT

The present invention relates to an apparatus and method for redeeming otherwise closed and concealed information contained in audio signals. This includes both the primary reference signal, and a plurality of redundant duplicate signals, substantially identical in all respects to the primary reference signal except in relation to magnitude and phase, for the purpose of unfolding, or opening the audio signal content into layers that result in an omni-directional acoustic signal, representing the sound as it would behave in nature. The audio reproduction system uses an inphase circuit and a separate phase layering technique circuit to drive independent multiple mixed channels, to produce an open, substantially complete sound from a discrete audio signal, for the purpose of enabling a substantially complete audio signal to be formed, or to transform existing incomplete audio signals into a substantially complete audio signal.

I CLAIM:

1. An audio reproduction process comprising the steps of:

selecting a discrete signal source;

producing a reference signal from said selected discrete signal source for producing an output of an in-phase reference signal;

producing an inverted-phase signal from said selected discrete signal source for producing an output of an out-of-phase signal;

producing a phase layered signal from said discrete signal source; and

mixing said reference signal and said inverted phase signal and said phase layered signal to form a composite output signal for the reproduction of sound.

2. The audio reproduction process in accordance with claim 1 in which the step of producing a phase layered signal includes producing a phase-layered treble signal and a phase layered bass signal for producing phase layered treble and bass signals.

3. The audio reproduction process in accordance with claim 2 including mixing left and right inputs of said selected discrete signal for producing said phase-layered treble signal and said phase-layered bass signal.

4. The audio reproduction process in accordance with claim 3 in which said produced inverted phase signal is created in parallel circuits each circuit combining the discrete signal left and right inputs.

5. The audio reproduction system in accordance with claim 4 in which the step of producing said inverted phase signal includes producing and combining a left minus right signal and a right minus left signal for an inverted phase signal.

6. The audio reproduction process in accordance with claim 5 in which each said parallel inverted phase signal is coupled to a linked voltage controlled amplifier.

7. An audio reproduction system comprising:

a discrete signal source;

a reference signal circuit coupled to said discrete signal source for producing an in-phase reference signal;

a phase inverting signal circuit coupled to said discrete signal source for producing an out-of-phase signal from said discrete signal source;

a phase-layered treble signal circuit coupled to said discrete signal source for producing a phase-layered treble signal from said discrete signal source;

a phase-layered bass signal circuit coupled to said discrete signal source for producing a phase-layered bass signal from said discrete signal source; and an output circuit coupled to the outputs from said reference signal circuit and from said phase inverting signal circuit and from said phase-layered treble signal circuit and from said phase-layered bass signal to form a composite output signal.

8. The audio reproduction system in accordance with claim 7 in which said output circuit includes a mixer for mixing said reference signal, said phase inverted signal, and said phase-layered treble signal and said phase-layered bass signal to form a composite output signal.

9. The audio reproduction system in accordance with claim 8 in which said phase inverting signal circuit includes an inverter circuit.

10. The audio reproduction system in accordance with claim 9 in which said phase-layered treble and phase-layered bass signal circuits each includes an inverter circuit.

11. The audio reproduction system in accordance with claim 10 in which said discrete signal source includes left and right signal inputs.

12. The audio reproduction system in accordance with claim 11 in which said discrete signal source left and right signal inputs are coupled to a mixer to produce a combined signal coupled to said phase-layered treble and bass circuits.

13. The audio reproduction system in accordance with claim 12 in which said phase inverting signal circuit has a pair of parallel circuits each combining the discrete signal source left and right signals.

14. The audio reproduction system in accordance with claim 13 in which one of said phase inverting signal circuit parallel circuits has a left - right filter and the other has a right - left filter.

15. The audio reproduction system in accordance with claim 14 in which each said phase-layered parallel circuit is connected to a voltage controlled amplifier.

16. An audio reproduction system comprising:

a discrete signal source;

a plurality of transducer voice coils forming part of at least one transducer;

a first circuit connected to said signal source and having an in-phase output therefrom coupled to one of said plurality of transducer voice coils; and

a second circuit connected to said signal source and having an out-of-phase output connected to a second of said plurality of transducer voice coils;

whereby an audio reproduction system reproduces said discrete signal source through at least one audio transducer.

17. The audio reproduction system of claim 16 in which said second circuit includes an inverter circuit.

18. The audio reproduction system of claim 17 in which said first and second circuits each includes an amplifier therein.

19. The audio reproduction system of claim 18 having a plurality of audio transducers, each having at least one of said plurality of voice coils.

20. The audio reproduction system of claim 19 in which each said transducer has two voice coils.

21. The audio reproduction system of claim 16 in which said transducer has four voice coils.

22. The audio reproduction system of claim 16 in which said discrete audio signal is a monophonic signal.

23. The audio reproduction system of claim 16 in which said discrete audio signal is a stereo signal.

24. The audio reproduction system of claim 16 in which said first and second circuits each includes a mixer.

25. The audio reproduction system of claim 24 including a third circuit connected to said signal source and having a high pass filter therein generating a phase-layered treble output therefrom.

26. The audio reproduction system of claim 25 including a fourth circuit connected to said signal source and having a low pass filter therein for generating a phase-layered bass output therefrom.

27. The audio reproduction system of claim 26 including an output circuit having a mixer therein for mixing said first, second, third and fourth circuit outputs to produce a composite signal output.

28. An audio reproduction system comprising:

a discrete signal source;

a first amplifier having an input and an output, said input being connected to said discrete signal source;

a second amplifier having an input and an output, said input being connected to said discrete signal source;

a plurality of transducer voice coils forming part of at least one transducer;

two of said plurality of voice coils being connected in-phase to said first amplifier output; and

two of said plurality of voice coils being connected out-of-phase to said second amplifier;

whereby one discrete audio signal is reproduced both in-phase and out-of-phase simultaneously with multiple transducer voice coils driven by two amplifiers.

29. The audio reproduction system in accordance with claim 28 having two transducers each having two of said plurality of voice coils, one said transducer being connected to said first amplifier and the other transducer being connected to said first amplifier and the other transducer being connected to said second amplifier.

30. The audio reproduction system in accordance with claim 29 having one transducer having four voice coils.

31. The audio reproduction system in accordance with claim 30 in which said discrete audio signal is a monophonic signal having a splitter applying the same signal to each amplifier.

32. An audio reproduction process comprising the steps of: selecting a discrete signal source;

splitting the selected discrete signal source;

applying the selected discrete signal source to a first circuit having an in-phase signal output;

applying the selected discrete signal source to a second circuit having an out-of-phase signal output; and

applying the selected discrete signal source to a third circuit having a phase layering signal output;

combining the signal outputs from the first, second and third circuits to produce an audio output signal for driving a transducer;

thereby producing audio sound having phase layered components.

33. An audio reproduction process in accordance with claim 32 in which the step of applying said selected discrete signal to a third circuit includes applying said signal to a phase layered treble circuit and to a phase-layered bass circuit.

34. An audio reproduction process in accordance with claim 33 including the step of adjusting the phase of the output signal of said phase-layered treble circuit and phase-layered bass circuit.

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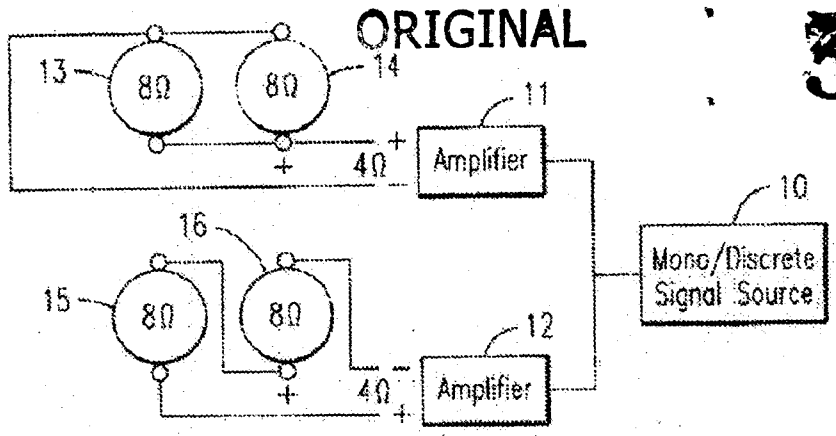

FIG. 1

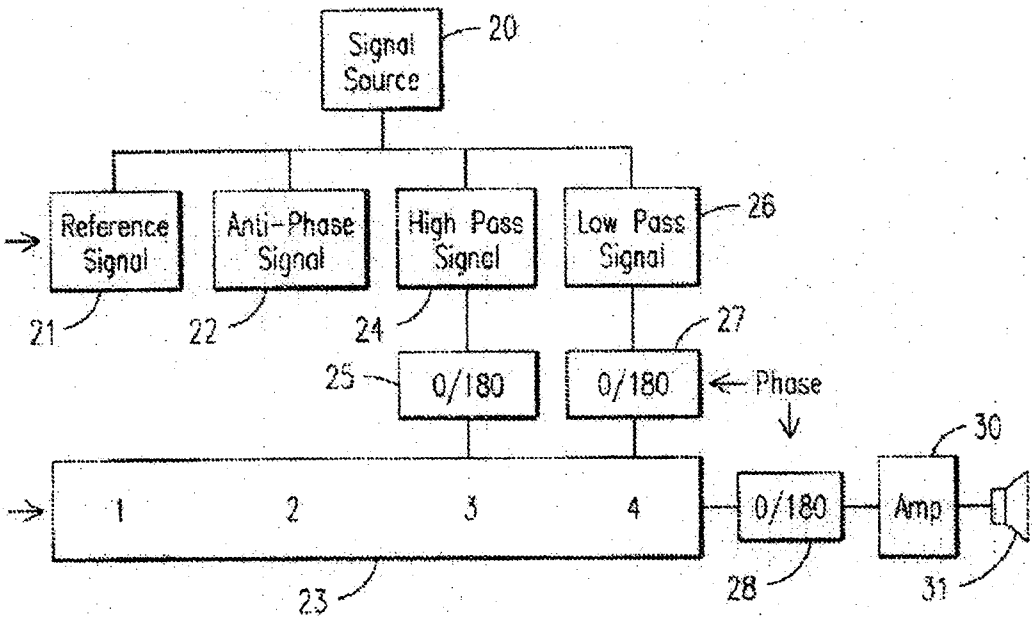

FIG. 2

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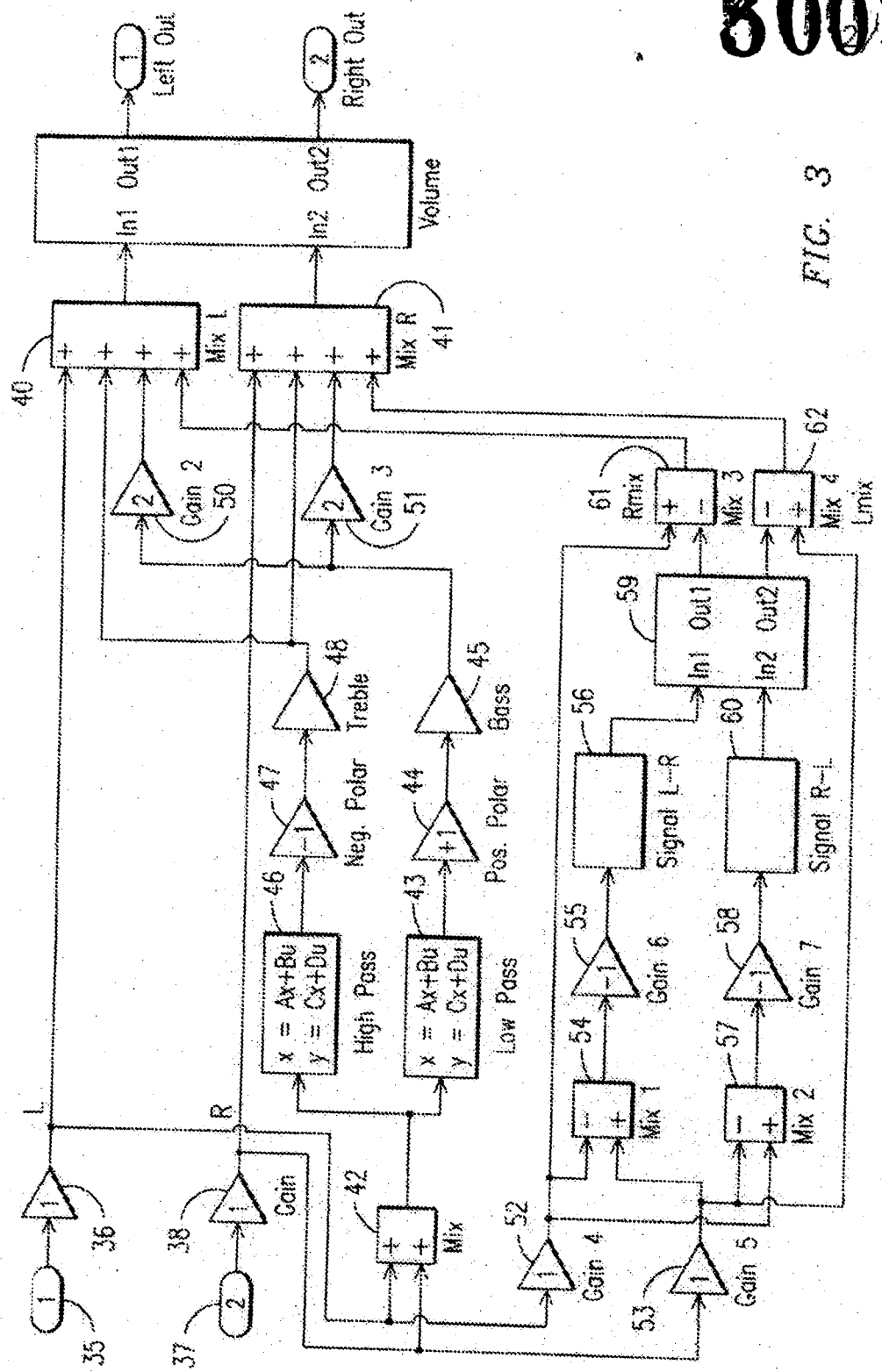

FIG. 3

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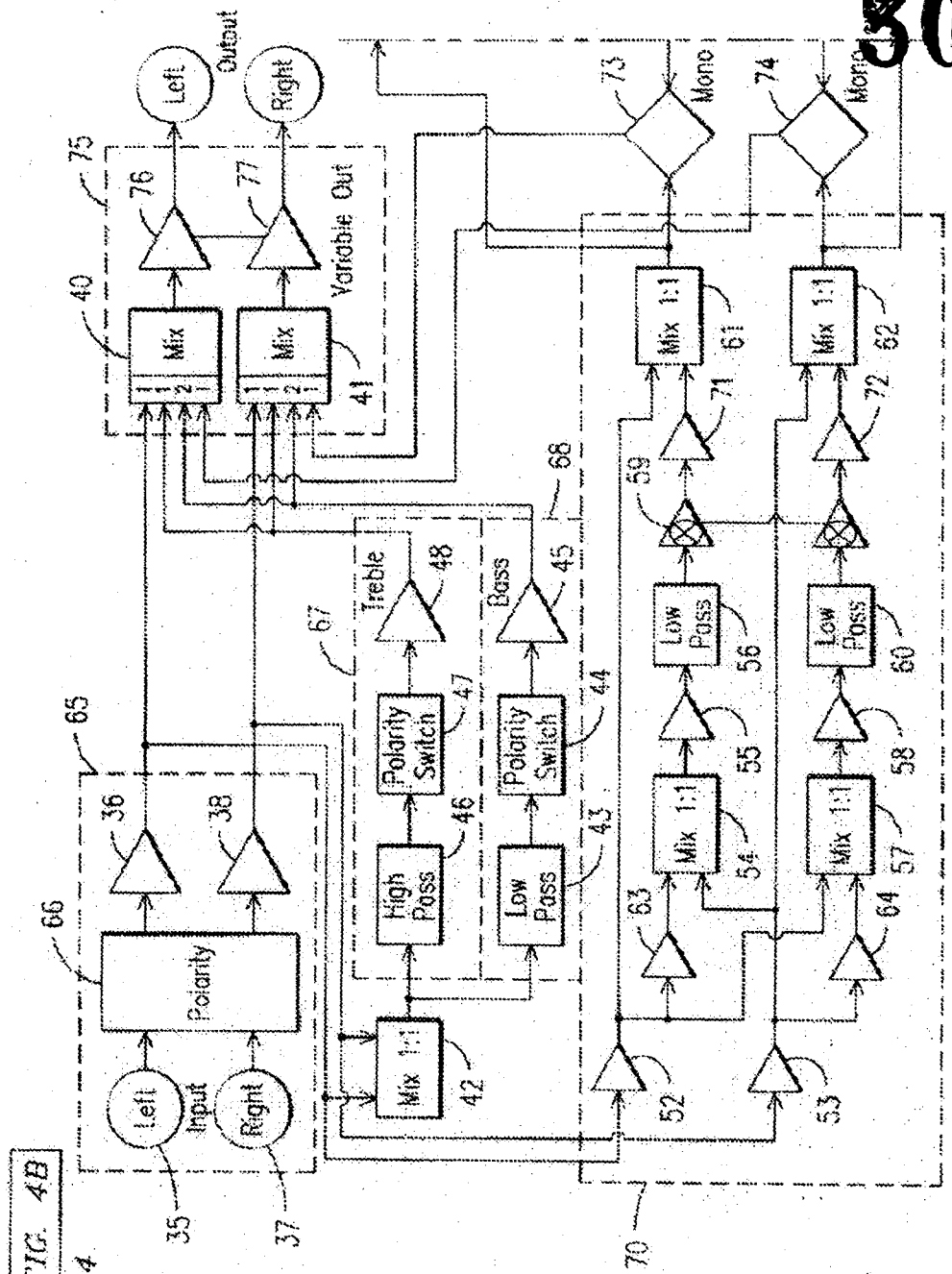

FIG. 4

FIG. 4A | FIG. 4B

FIG. 4A

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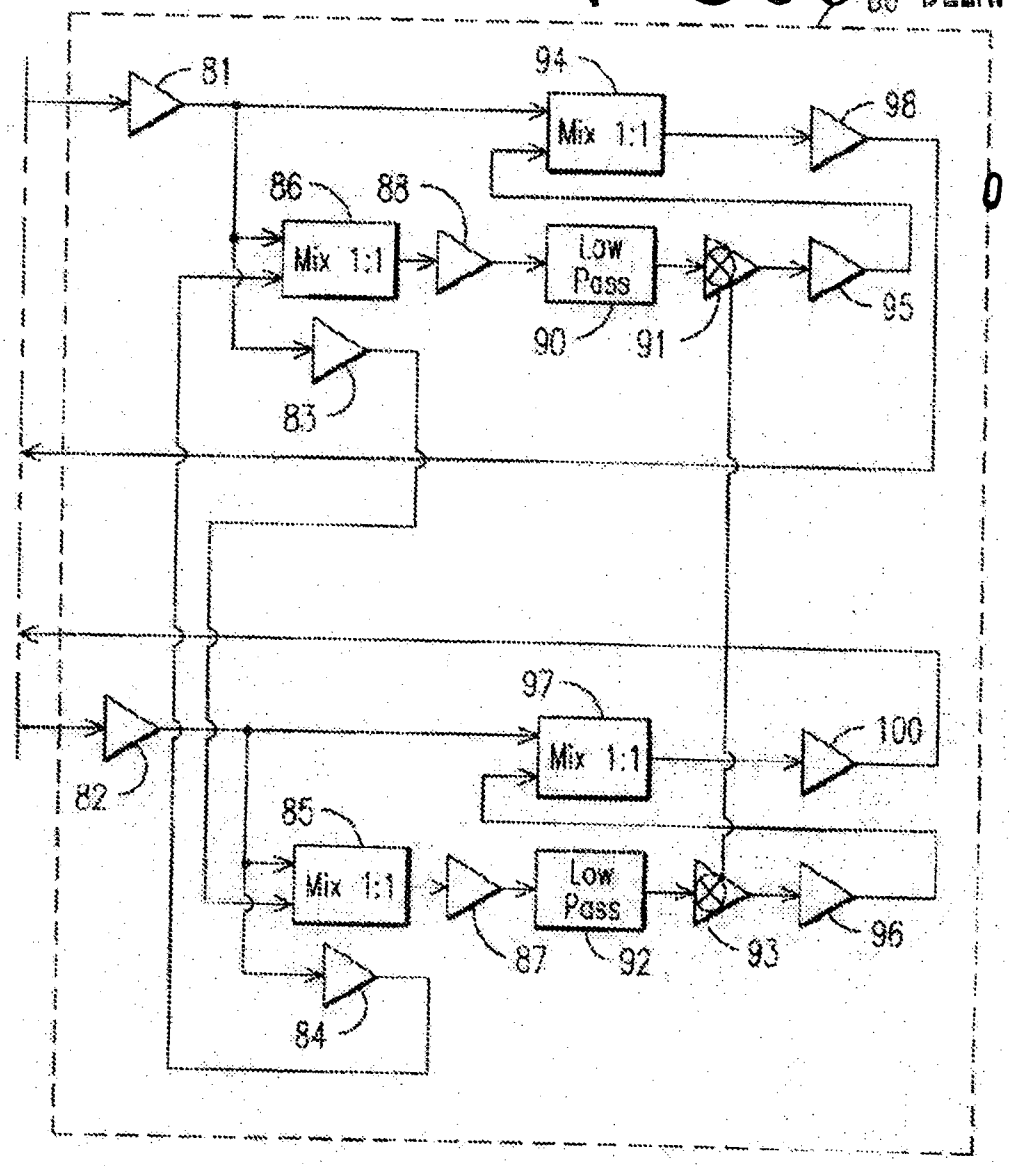

FIG. 4B

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type. Nor are filters limited to angle, or degree, such as 6dB, 12dB, 18dB, or 24dB. Furthermore, frequency setting, such as 100 Hz for low pass or 16kHz for high pass are only used as examples for purposes of description.

45] Figure 1 of the drawings illustrates a block diagram of a passive configuration that can operate with loudspeakers connected to an audio amplifier without an otherwise active circuit. A monophonic or discrete signal source 10 applies a discrete source signal to a first audio amplifier 11 and to a second audio amplifier 12. Amplifier 11 has its output connected to a pair of speakers 13 and 14, each having a voice coil therein to form a first circuit leg. Amplifier 12 has its output connected to a pair of speakers 15 and 16, each having a voice coil therein to form a second circuit leg. Each leg of the circuit can also be configured as one loudspeaker having two voice coils. The speakers can have any impedance load desired but for this example each speaker is 8 ohms and each circuit leg is 4 ohms. It should also be noted that one single amplifier can be used in combination with a specially designed single loudspeaker having 4 voice coils.

46] The first circuit leg is a parallel circuit connected in-phase, meaning that the amplifier 11 positive connection is connected to the positive connections of both speakers 13 and 14 and the negative connection of the amplifier 11 is connected to the negative connection of both speakers 13 and 14. The second circuit leg is a parallel series circuit that is connected out-of-phase with the negative of speaker 15 being connected to the positive of speaker 16 and the positive of speaker 15 connected to the positive negative terminal of amplifier 12. The negative of speaker 16 is connected to the negative of amplifier 12. The circuit can also be configured by combining the first and second circuit legs in other ways, such as using a single amplifier connected to a quadruple voice coil loudspeaker or transducer. The configuration illustrated in Figure 1 has the ability to control gains of each circuit leg, and match the impedances of each circuit leg in a simple manner. Each leg of Figure 1 independently provides the listener with the sound character of the first circuit leg that is consistent with the character of the way audio signals are designed to sound according to industry compliance, or in-phase. The first and second legs individually of Figure 1 provide partial reproduction of the audio signal such that if the listener listens to the

second circuit leg alone, and without hearing the first circuit leg at the same time, the listener thinks the sound is distant, having greater spatial height, width, and depth, yet seeming far away. Combining the two circuit legs simultaneously reproduces a substantially complete audio signal. The sound of the original acoustic event, recording, or reproduced transmission of voice, music, or other audio, is heard substantially as in the original event. The first and second circuit legs should be matched substantially in equal amplitude in order for the substantially complete signal to be formed. If either differs significantly in amplitude, the one with the hotter signal strength will override the other, and the total signal will not be optimally balanced.

Therefore, the resulting signal will be less than a substantially complete signal, for example, a signal that has been processed and has the effect of being based on addition, or subtraction of amplitudes and phase, rather than a composite circuit, or substantially complete audio signal. Thus, in this embodiment it is assumed that each speaker is a full range speaker and that the circuit is after the amplifier so that the complete audio signal is being created in the physical air, and, therefore, behaves in a similar and like manner to the original acoustic event. Thus, high pass and low pass crossovers are not necessary in this embodiment.

47] On the other hand, when using existing audio equipment, usually having multiple loudspeakers, each of which may be a 2 or 3 way (or beyond) speaker system, which usually have additional crossovers that further distort phase information, with each having a limited radiation pattern, high and low paths may better define the physical characteristics of the acoustic information contained within the signal. Thus, with the various high and low passes and phase controls an active circuit may be utilized to generate a substantially whole, or virtually spherical, signal to the amplifier and speakers.

48] Figure 2 shows a basic block diagram for an active circuit for generating a substantially complete audio signal including high pass and low pass crossovers. By active, it is meant a circuit that requires power to operate and is connected in line before the signal