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ELECTRONIC MULTI-SOURCE SOUND PATTERN

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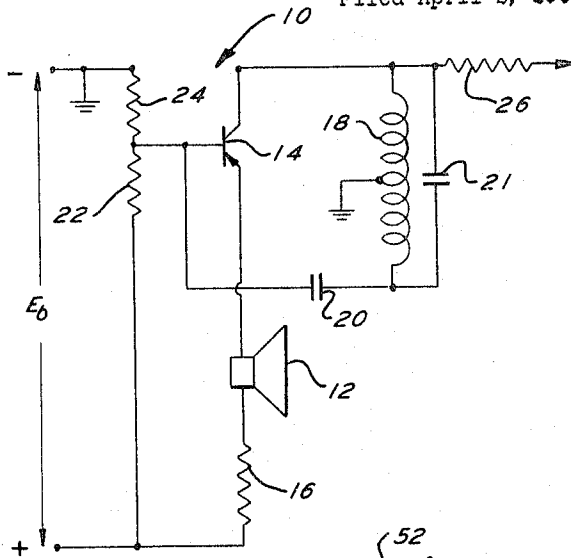


FIG. 1

FIG. 2

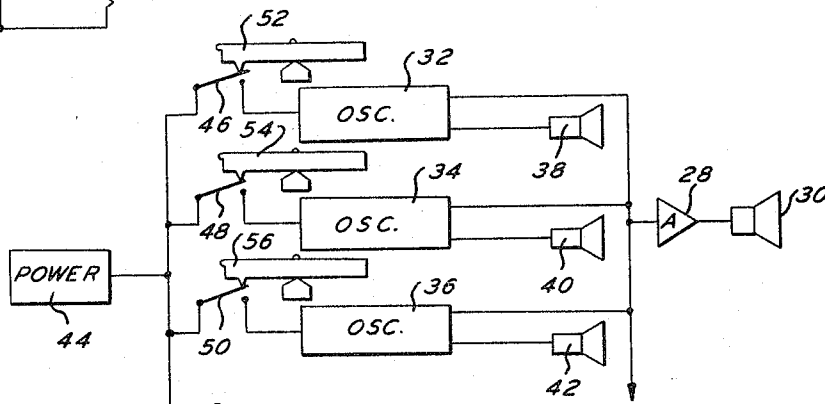
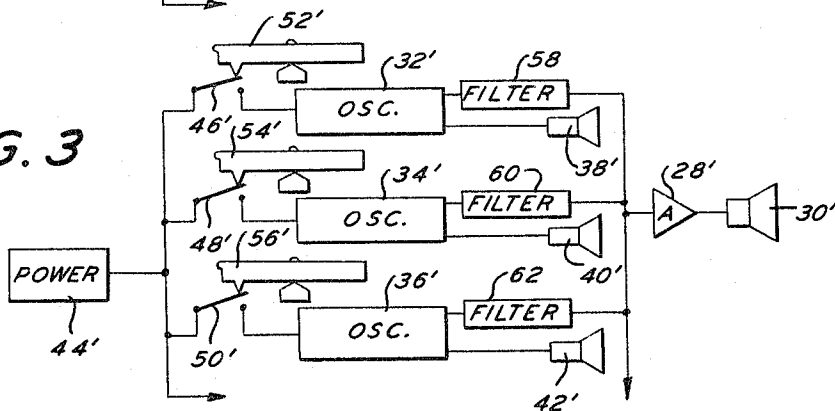


FIG. 3



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This invention relates to an electronic means for producing sound. More particularly it relates to an electronic means for producing a multiple source sound pattern.

In the past, electronic organs and similar electrical musical instruments have been designed to apply an electronic signal representing the desired sound output to one or several speaker units which respond to the electronic signal to produce the desired sound pattern. Each speaker unit may comprise several individual speakers adapted to produce a particular frequency range of sound, such as a woofer, a mid-range speaker, and a tweeter. Heretofore, such speaker units have been connected to the electronic signal producing portion of the organ in a manner that permits them to accept electronic signals from all or a substantial portion of the several signal producing circuits. Thus the same speaker unit may produce sounds extending over a relatively wide frequency range.

In a pipe organ a single pipe is provided for each note, and in a general way the number of musical notes produced by a pipe organ depends on the number of pipes. The note to be produced is generated by each individual pipe. Therefore a pipe organ has multiple individual point-sources of sound by virtue of having a single pipe for each frequency or note.

Multiple individual point-sources contribute to the overall quality of the so-called "organ sound" produced by pipe organs. It is recognized that multiple individual sources are a desirable component of "organ sound," and as such would enhance the quality of sound produced by an electronic organ if it is incorporated therein. The equivalent of multiple individual sound sources could be duplicated in an electronic organ by providing a separate speaker unit and amplifier for each note. This, however, would result in an extremely bulky and costly organ.

Analysis has shown that the major portion of the multiple point-source effect is contributed by the higher frequencies. This is believed to be because the higher frequencies are directional. The lower frequencies, on the other hand, tend to spread out. Thus, the listener hears higher frequency notes as coming directly from the exposed tone source, which in the case of a pipe organ is a pipe producing a higher frequency note, or a lower frequency note which includes higher partials.

Therefore, it is an object of this invention to provide a novel electronic means for producing the multiple point-source effect of pipe organs.

It is another object of this invention to provide a novel means of duplicating the multiple point-source effect that is relatively inexpensive and does not require additional amplifier means.

It is yet another object of this invention to provide an electronic means for producing the multiple point-source effect without using additional electronic circuits for each note.

Still another object of this invention is the provision of a novel means for incorporating the multiple tone source effect in an electronic organ.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there are shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

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FIGURE 1 is a schematic showing of the electronic circuitry for the production of a point-source of sound.

FIGURE 2 is a schematic block diagram showing in combined form the circuitry for the production of a multiple point-source of sound.

FIGURE 3 is a modified form of the invention shown in FIGURE 2.

Referring now to FIGURE 1, there is shown a schematic drawing of an electronic circuit for generating a point-source of sound, designated generally as 10.

Basically the circuit is of the type known as a Hartley oscillator, and it is utilized to generate a tone at a predetermined frequency that may simulate the tone generated in a pipe of a pipe organ. As shown, a high frequency loud-speaker 12 is connected into the emitter circuit of the transistor 14, together with the resistor 16. An inductance 18, which is center tapped to ground is connected in the collector circuit, together with capacitor 20. The collector circuit may be tuned by varying either the reactance of the inductance 18 or the capacitance of the capacitor 21, connected in parallel with inductance 18. The base of the transistor 14 is connected through resistor 22 to the positive side of a power source indicated by voltage in E_b , and is connected through resistor 24 to ground potential of the voltage E_b .

The function of the elements of the above described circuit need not be set forth in detail because in combination they form a conventional Hartley oscillator, the operation of which is known to those skilled in the art. When energized by a power source such as voltage E_b , the oscillator will generate an alternating signal at a frequency determined by the electrical value of the components making up the circuit. Those who are skilled in the art can readily choose values that will cause the circuit to generate a signal at a frequency equal to that of a musical note. The output signal of the circuit 10 is coupled through resistor 26 to an amplifier 28, as shown in FIGURE 2. The amplifier 28 amplifies the signal and applies it to a loud-speaker unit 30 for conversion into sound. The oscillator may include a wave shaping circuit (not shown) adapted to modify the signal to give it characteristics of organ sound. Such wave shaping circuits are known to those skilled in the art and it is not thought to be necessary to describe them here.

The transistor 14 may be a 200 milli-watt audio transistor, and the voltage E_b may be 12 volts direct current, or random modulated direct current. When energized, the circuit will generate a signal of sufficient power not only to permit the amplifier 28 and speaker unit 30 to convert the signal to sound with minimum distortion but also to drive the high frequency loud-speaker 12. Because high frequency loud-speakers require very little power, the power ordinarily generated in the emitter circuit will be sufficient to drive them. It should be noted that the high frequency loud-speaker 12 could be connected in the collector circuit of transistor 14.

The schematic of FIGURE 2 shows a block diagram in which several oscillators similar to the oscillator circuit 10 of FIGURE 1 are coupled to a common amplifier 28 and common loud-speaker unit 30. The oscillators 32, 34 and 36 may differ only in that they are adjusted to produce signals at different frequencies. As shown diagrammatically, each oscillator is connected to an individual high frequency speaker 38, 40 and 42 in the same manner that high frequency speaker 12 is connected into the circuit of FIGURE 1. A common source of power is connected to the contacts 46, 48 and 50, each of which may be closed to energize the respective oscillators 32-36 connected thereto, by depressing one of the organ keys 52, 54 and 56. When one of said keys 52-56, which in practice comprise a portion of the organ keyboard, is de-

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pressed and the associated oscillator circuit energized, the high frequency portion of the signal in the emitter circuit will drive the high frequency loud-speaker connected thereto. On the other hand, the normal signal from the oscillator is coupled from the collector circuit to the common amplifier 28 and loud-speaker 30.

Thus it can be seen that a high frequency source of sound for each individual note of an electronic organ has been provided without the necessity of using a separate amplifier for each note. Each oscillator of the electronic system of the organ drives its own associated high frequency loud-speaker plus a common audio system. The natural response of the high frequency loud-speakers limit their output to the high frequency tones or components of tones. And since the higher frequencies produce the multiple point-source effect in "organ sound" the resulting composite sound produced by the electronic organ has the multiple point-source characteristic of a pipe organ. The high frequency loud-speakers can be located for the best sound distribution. The actual location will depend upon the situation presented, and it would be readily determined by those skilled in the art.

Referring to FIGURE 3 there is shown a schematic block diagram embodying a modified form of the invention. FIGURE 3 is similar to FIGURE 2, and like elements have been designated by prime numbers.

In FIGURE 3, filters 58, 60 and 62 have been added between oscillators 32'-36' and common amplifier 28'. Said filters 52-62 are designed to pass only low and medium frequency signals. Accordingly, amplifier 28' can be limited to amplifying a narrower frequency with a resulting reduction in distortion and cost. The higher frequency signals are produced by the high frequency loud-speakers 38'-42' which are driven by the oscillators 32'-36' in the manner shown in FIGURE 1. A common power source 44' provides power to drive the oscillators 32'-36'.

Thus it may be seen that an electronic means of simulating the multiple point-source effect of a pipe organ has been disclosed. Further, the system requires only the addition of a high frequency speaker in the oscillator circuits. There is no necessity for providing costly duplication of amplifiers and wave shaping circuits.

In the specification, reference to audio frequencies means frequencies of approximately 15 to 20,000 cycles per second. Reference to high frequency speakers means speakers capable of transducing electrical signals into sound at frequencies of approximately 1,500 to 20,000 cycles per second. Further, although a transistor Hartley oscillator has been used to illustrate the invention, other oscillator circuits may be used, and vacuum tubes may be substituted for the transistors. The disclosed circuit is preferred, however, because it provides a high power gain with relatively simple circuitry.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. In an electronic organ, means to duplicate the multiple point-source sound effect of pipe organs comprising signal generating means, key means to selectively actuate said signal generating means, amplification and transducer means to amplify the generated signal and transduce it into sound, and high frequency transducer means connected directly to said generator means for transducing high frequency portions of said signal into sound.

2. An electronic organ in accordance with claim 1 wherein said signal generating means is an oscillator.

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3. An electronic organ in accordance with claim 1 wherein said signal generating means is a transistor oscillator and said high frequency transducer is a high frequency speaker connected into the transistor emitter circuit.

4. An electronic organ in accordance with claim 1 wherein said signal generating means is a transistor oscillator and said high frequency transducer is a high frequency speaker connected into the transistor collector circuit.

5. An electronic means for simulating the multiple point-source sound effect of pipe organs comprising a plurality of keys, a plurality of electrical generators for generating audio frequency electrical signals, an audio converter connected to said electrical generators to convert said audio frequency electrical signals into an audio output signal, a plurality of high frequency audio converters each connected directly to one of said electrical generators to convert the high frequency portion of said audio frequency signal into a high frequency audio output signal, each of said keys being associated with one of said electrical generators and being operative to control the generation of an audio frequency electrical signal.

6. An electronic means for simulating the multiple point-source sound effect of a pipe organ in accordance with claim 5 wherein said electrical generators are oscillators.

7. An electronic means for simulating the multiple point-source sound effect of a pipe organ in accordance with claim 5 wherein said electrical generators are transistor oscillators and said high frequency audio converters are connected directly into the transistor emitter circuit.

8. An electronic means for simulating the multiple point-source sound effect of a pipe organ in accordance with claim 5 wherein said electrical generators are transistor oscillators and said high frequency audio converters are connected directly into the transistor collector circuit.

9. An electronic means for simulating the multiple point-source sound effect of pipe organs in accordance with claim 6 wherein said audio converter comprises an amplifier for amplifying the audio frequency electrical signal and a loud-speaker for transducing the audio frequency signal into sound.

10. An electronic means for simulating the multiple point-source sound effect of a pipe organ in accordance with claim 7 wherein said high frequency audio converters are loud-speakers responsive only to high frequency signals.

11. An electronic organ comprising a keyboard having a plurality of keys thereon, at least one transistor oscillator associated with each key for producing audio frequency electrical signals, an amplifier connected to each of said oscillators to amplify the audio frequency signals produced by said oscillators, a loud-speaker connected to the output of said amplifier for transducing said amplified audio frequency signals into sound, at least one high frequency loud-speaker connected in each of said oscillator circuits to transduce high frequency signals generated by said oscillator circuits into high frequency sound, and each of said keys being operative to control the production of an audio frequency electrical signal by its associated oscillator.

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