

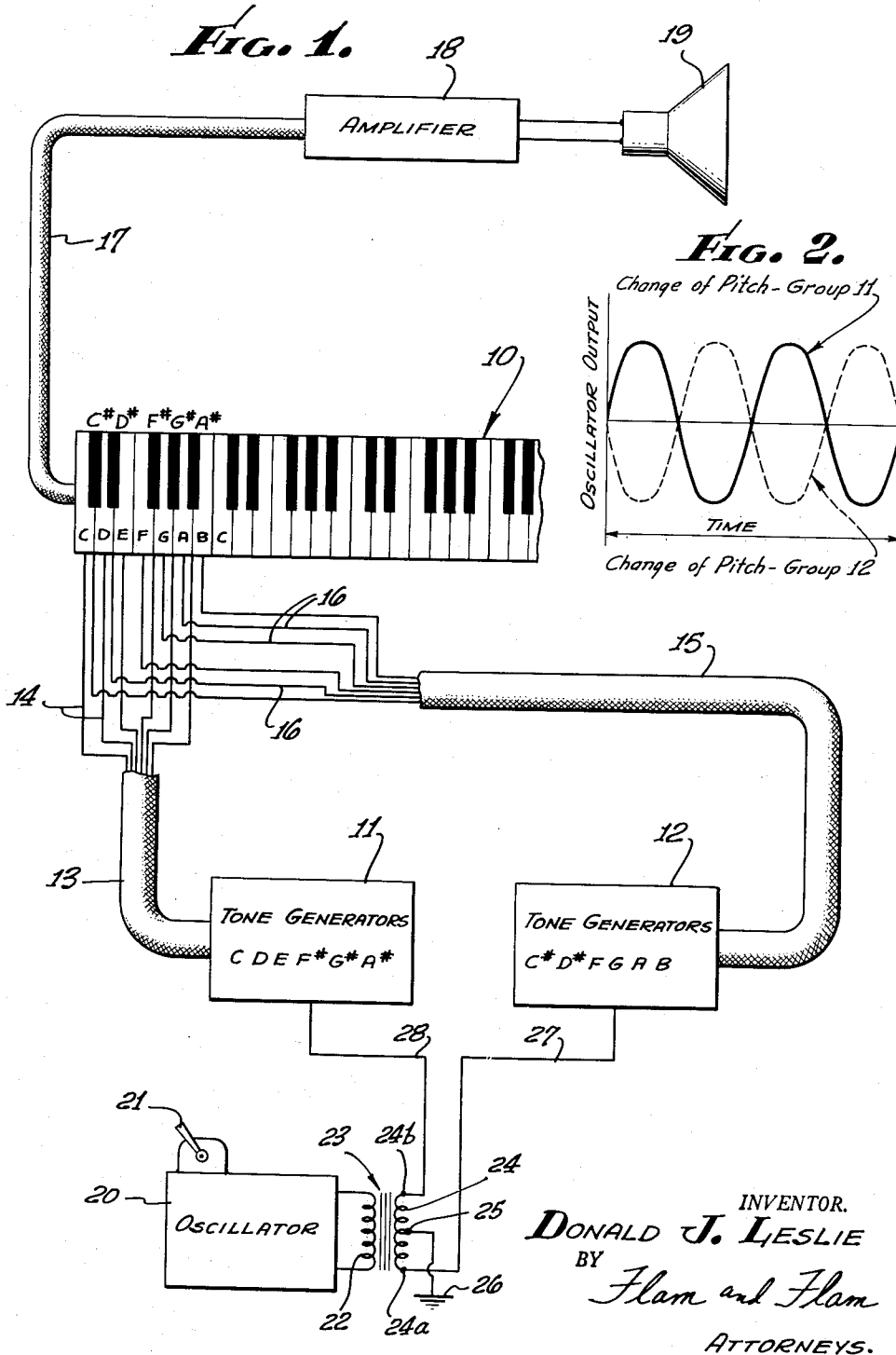
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VIBRATO-OSCILLATOR FOR ELECTRONIC ORGANS OR THE LIKE

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**VIBRATO-OSCILLATOR FOR ELECTRONIC  
ORGANS OR THE LIKE**

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4 Claims. (Cl. 84-1.25)

This invention relates to the production of musical tones, especially by the aid of an electric organ.

A certain "beat effect" problem arises in electronic organs when a plurality of notes are sounded together. This is due to the compromises inherent in the tempered scale. Two impulses corresponding to notes in either fourth or fifth musical interval relationship with respect to each other create the most serious problem. Considering A (440 c.p.s.) and E (659 c.p.s.) five intervals above it, the third harmonic of the former has a frequency of 1320 c.p.s., and the second harmonic of the latter has a frequency of 1318.52 c.p.s. If the tone generators for these notes are simultaneously operable, the electrical impulses at 1318.52 and 1320 c.p.s. move into and out of reinforcing relationship with respect to each other, and an audible "beep" recurs at the rate of one and a half times a second. The effect is quite annoying, especially to the ears of one musically trained. The same or similar effect is created by any impulses corresponding to notes in fourth or fifth musical relationship with respect to each other.

In my prior Patent No. 2,596,258, issued May 13, 1952, and entitled Electric Organ Speaker System, there

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the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a diagrammatic view of a system incorporating the present invention; and

FIG. 2 is a graph illustrating the change of pitch of the various impulses.

In FIG. 1 there is diagrammatically illustrated a keyboard 10, the keys of which in a conventional manner control circuits for corresponding tone generators.

The tone generators in the present instance are shown grouped electrically, but not necessarily physically, by the blocks 11 and 12. Contained within the block 11 are all of the tone generators having fundamental frequencies corresponding to the notes C, D, E, F#, G# and A#. Within the block 12 are all of the generators for producing impulses corresponding to the notes C#, D#, F, G, A and B.

By segregating generators corresponding to alternate half-tones, it will be appreciated, from a consideration of the following chart, that any one note (or generator corresponding thereto) exists in one group while notes in fourth or fifth musical interval relationship with respect thereto exist in the other group. The fourth and fifth D#, which are, respectively, G# and A#, fall in group 11 while D# falls in group 12.

Reference.....	{Group 12. A		B	C	C#	D	D#	F	G	
	{Group 11. A#			F		G		A		
Fourth.....	{Group 12. D		E			A		B		
	{Group 11. D#			G		A#				
Fifth.....	{Group 12. E		F#					C		
	{Group 11. E#			G#		A#				

is disclosed a system for eliminating these "beat effects" by utilizing two electric-acoustic channels between which impulses corresponding to tones in half-tone relationship are segregated. By virtue of that segregation, impulses, corresponding to A and E or any other notes in either fourth or fifth musical relationship with respect to each other, appear in different electrical-acoustic channels. There is no electrical interplay of the impulses, and the "beat effect" is solved.

The primary object of this invention is to provide a new system whereby the "beat effects" may be largely minimized.

Another object of this invention is to provide a system of this character that does not depend upon the use of two separate electrical-acoustic channels.

The invention is implemented by a provision of a vibrato oscillator connected in such manner that the pitch variations of impulses, corresponding to tones in fourth or fifth musical relationship with respect to each other, are out of phase. In other words, while A goes sharp, E goes flat, for example, and vice versa. The regularity of the cyclic reinforcement is, accordingly, interrupted and the "beat effect" is minimized, and to an extent corresponding to the extent of pitch variation or amplitude of vibrato. The invention is carried out by segregating generators in the same manner as described in said prior patent, but by connecting the output of the vibrato oscillator in phase displaced relations to the generators of the respective segregated groups. Yet there is a single electrical output.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in

A cable 13 from the generators of the group 11 carries a plurality of conductors 14 extending to the switches controlled by the keyboard 10. The position of the conductors 14 at the keyboard diagrammatically illustrates connections. A cable 15 from group 12 contains conductors 16 similarly extending to the keyboard 10.

Extending from the keyboard 10 is a conductor or coaxial cable 17 which leads to a power amplifier 18 and a single speaker system illustrated diagrammatically by speaker 19.

It will be understood that there may be several generators for any particular note to obtain different tonal qualities, and controlled by conventional stops (not shown) associated with the keyboard 10. Furthermore, there may be two or more manuals. All this is immaterial, the important relationship being that all generators, except perhaps those substantially devoid of harmonic content and those for pedal notes, are subject to the alternate half-tone segregation.

While in the present instance the keyboard 10 is interposed between the speaker system 19, the amplifier 18 and the tone generators 11 and 12, it will, of course, be understood that the tone generators in many instances will be actually interposed between keyboard 10 and its associated switches on the one hand and the power amplifier 18 and the speaker system 19 on the other.

A vibrato oscillator 20 controlled by a switch 21 provides a signal having a frequency of approximately five to eight cycles per second. This signal is used periodically to detune the tone generators, and a vibrato or tremolo effect is obtained.

In the present example, the oscillator 20 is shown as having an output connected to the primary 22 of a transformer 23. The secondary 24 of the transformer

provides a push-pull type output, a center tap 25 of the secondary being grounded, as indicated by the ground connection 26. The oscillator output is thus divided into two parts, as illustrated in FIG. 2, the output parts being displaced in the phase by 180°. One end 24a of the secondary winding 24 is connected to the tone generators of the group indicated by the block 12 and by the connection 27. The other end 24b of the secondary winding 24 is connected to the other group of tone generators within the block 11 and as indicated by the connection 28. Referring to FIG. 2, the oscillator output determines the change of pitch of impulses produced by the generators. The sinusoidal output means that the pitch increases and decreases periodically and at the rate of about seven cycles per second.

The pitch of generators within one group increases while the pitch of impulses in the other group decreases. Thus, it is obvious that as A, for example, in group 12 swings sharp, E swings flat. The regular cyclic reinforcement of slightly out-of-tune harmonics is thus broken up and to an extent corresponding to the extent of determining which in turn corresponds to the amplitude of the vibrato oscillator output. Whenever the oscillator 20 is operated, the "beat effects" are minimized.

Instead of a push pull transformer, any other phase shifting device which will maintain a fixed phase difference between the two vibrato signals will be equally operative. To achieve the desired effects, the fixed phase difference must be between 90° and 270°.

The inventor claims:

1. In a system for producing musical tones: a set of generators for creating musical impulses corresponding to a set of notes in successive half-tone relationship with respect to each other; a vibrato oscillator providing a signal for modifying operation of the generators for adding a vibrato component to the output of the generators; and means connecting the vibrato oscillator output to the generators in such manner that the oscillations imposed on generators in alternate half tone relationship are out of phase whereby beating due to the simultaneous sounding of notes, in both fourth and fifth musical interval relationship is substantially minimized.

2. In a system for producing musical tones: a set of generators for creating musical impulses corresponding to a set of notes in successive half-tone relationship with respect to each other; a vibrato oscillator providing a signal for modifying operation of the generators for adding

a vibrato component to the output of the generators; and means connecting the vibrato oscillator output to substantially each of the generators for the notes C, D, E, F#, G# and A# in out-of-phase relationship to the generators for the notes C#, D#, F, G, A and B whereby beating due to the simultaneous sounding of notes, in both fourth and fifth musical interval relationship is substantially minimized.

3. In a system for producing musical tones: a set of generators for creating musical impulses corresponding to a set of notes in successive half-tone relationship with respect to each other; a vibrato oscillator providing a signal for modifying operation of the generators for adding a vibrato component to the output of the generators; generators corresponding to notes in alternate half-tone relationship being respectively substantially exclusively grouped; a coupling transformer having a secondary connected in push pull relationship to the respective generator groups, and a primary driven by said vibrato oscillator whereby beating due to the simultaneous sounding of notes, in both fourth and fifth musical interval relationship is substantially minimized.

4. In a system for producing musical tones: a set of generators for creating musical impulses corresponding to a set of notes in successive half-tone relationship with respect to each other; a vibrato oscillator providing a signal for modifying operation of the generators for adding a vibrato component to the output of the generators; there being two groups of generators, one group substantially exclusively including generators for notes C, D, E, F#, G# and A# and the other group substantially exclusively including generators for notes C#, D#, F, G, A and B; and means connecting the vibrato oscillator output to the generators in such manner that the oscillations imposed on generators of one group are in fixed out-of-phase relationship with respect to generators of the other group in an amount between 90° and 270° whereby beating due to the simultaneous sounding of notes, in both fourth and fifth musical interval relationship is substantially minimized.

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