Oct. 14, 1952 M. MARTENOT 2,613,568

MUSICAL SOUND GENERATING DEVICE

Filed April 5, 1948 2 SHEETS—SHEET 1

Fig: 1

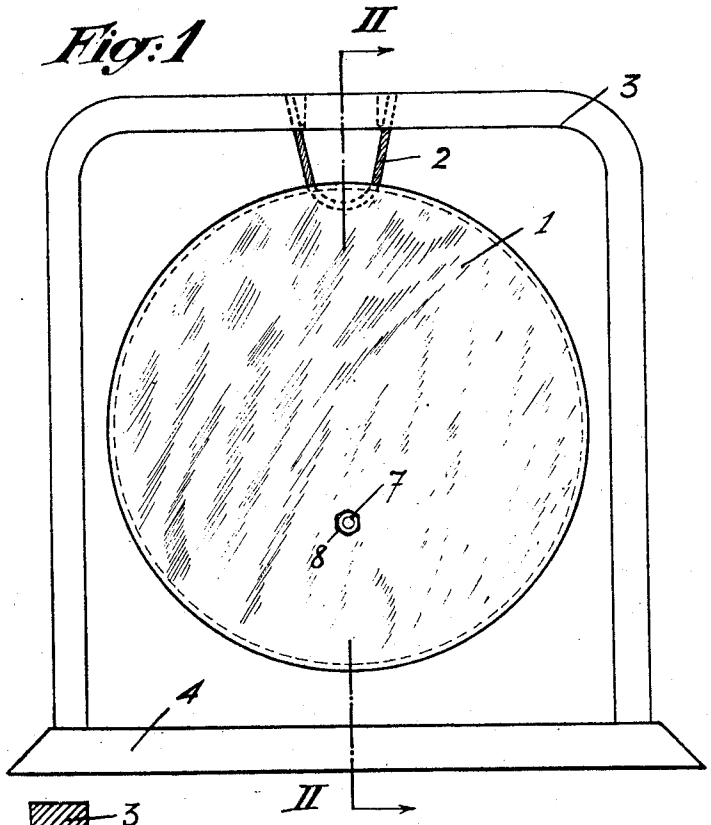

Fig: 2

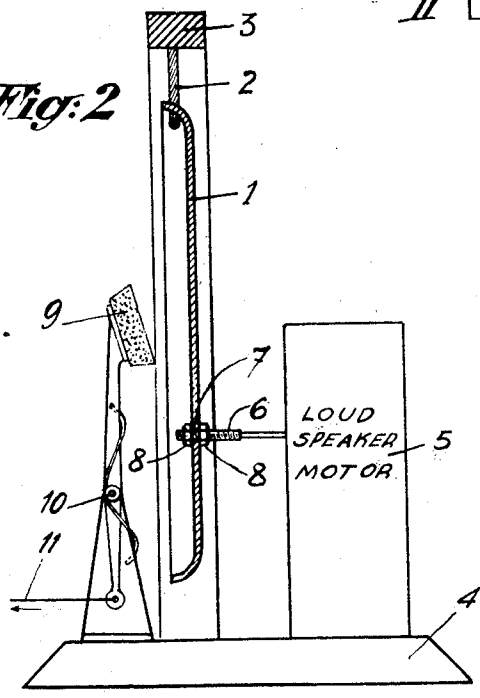

Fig: 5

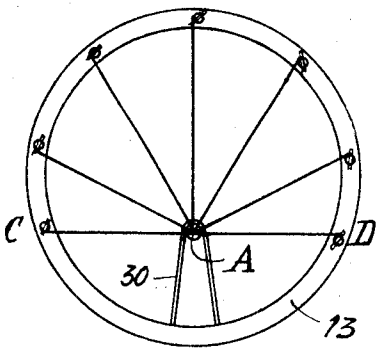

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Fig. 3

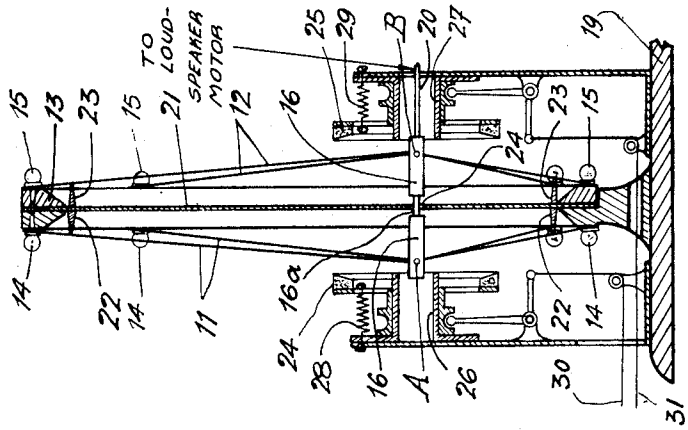
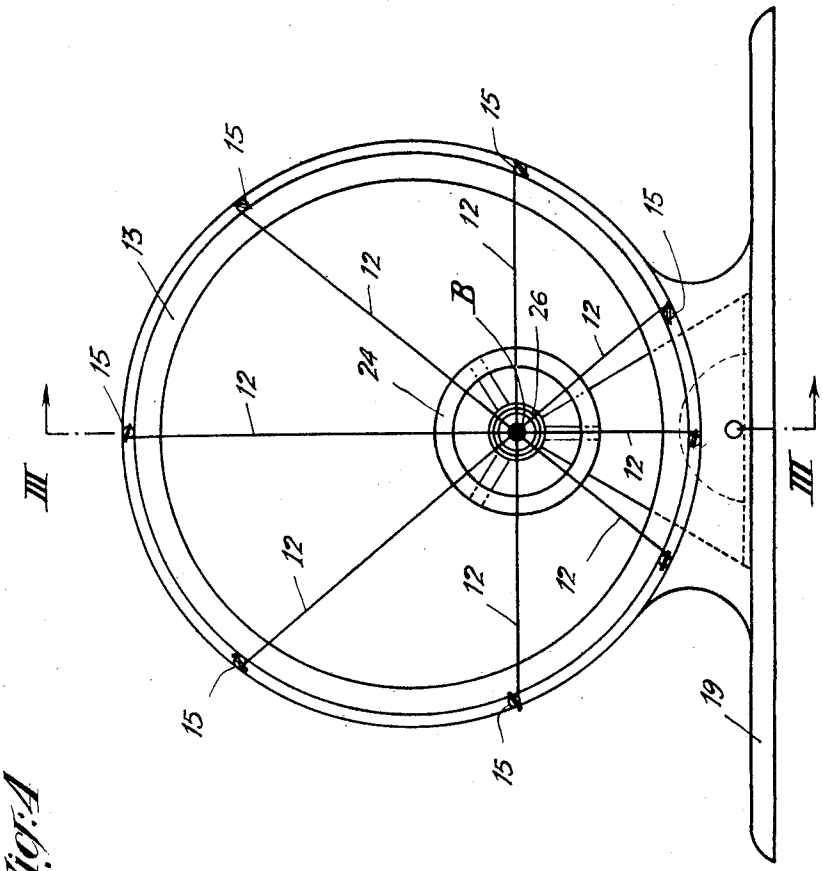


Fig. 4



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MUSICAL SOUND GENERATING DEVICE

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7 Claims. (Cl. 84—1.06)

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Most musical instruments using strings are so designed that a quick damping of the vibration is avoided. This is particularly true of piano and harp which cannot sustain a long resonance of the emitted sounds.

On the contrary, the sounds emitted by the electric or electronic instruments the output of which is connected to common loud-speakers cannot be sustained longer than the excitation time of the loud-speaker which presents the drawback of a certain dullness of the sounds.

Moreover it is to be observed that the common loud-speakers now available on the market are designed so as to obtain the greatest possible fidelity by reproducing with a minimum of distortion the sound modulations transmitted to the loud-speakers from the microphone, the radio receiver or the gramaphone with which they are associated. Their vibrating diaphragms are made as aperiodic as possible. However while in ordinary reproduction fidelity is the essential quality, on the contrary in the playing of an electric or electronic musical instrument the point of view is not the same and it seems that heretofore nobody has noticed this difference. A certain amount of distortion producing a timbre hitherto unknown may be then a desirable quality.

Such are the aspects of the technical problem. One object of my invention is to provide a sound generating device which is particularly adapted, on the one hand, to sustain the resonance of sounds longer than the excitation time of the loud-speaker and, on the other hand, to produce a quality of timbre unknown with the common loud-speakers.

In a first embodiment of my invention, the resonant body in which vibrations are induced by the modulated electric current is a gong plate. Such a plate which is usually made of a hammer-wrought alloy of copper and tin emits when excited a sound of a very high quality and vibrates, as a matter of fact, simultaneously at most musical frequencies.

Said plate may be operated by an ordinary, magnetic or moving-coil loud-speaker motor connected to one point preferably off-centered of said plate which is partially supported by a frame by means of an ordinary string for example, so that the damping may be reduced to a minimum.

It is to be understood that the gong plate may be replaced by any other body which is able, like said gong plate, to vibrate in several modes simultaneously, after being excited.

According to another embodiment of my invention, the multi-resonator comprises a number of vibratory strings of different natural resonance frequencies tightened within a frame and having a common point through which said strings are simultaneously excited from a conventional loud-speaker motor. There is preferably provided two sets of strings tightened on both sides of a flat frame and running over a double-nut which receives the impulses of the motor.

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The following description with reference to the accompanying drawing given as an illustration which does not limit my invention will provide an understanding of how the object of the invention may be realized. In the drawing:

Fig. 1 is a front view of one embodiment of my invention.

Fig. 2 is a section taken along line II—II.

Fig. 3 is a section of an alternative embodiment taken along line III—III of Fig. 4.

Fig. 4 is a front view showing the arrangement of the vibrating strings according to the embodiment shown in Fig. 3 and

Fig. 5 is another alternative embodiment.

In the embodiment of Fig. 1 the multi-resonator associated with the loud-speaker is constituted by a gong plate 1 linked at its upper edge by means of a string 2 to a rigid frame 3 provided with a base 4. On said base is secured a conventional loud-speaker motor 5 of any suitable type, electromagnetic or electrodynamic. The moving member of said motor is integrally connected to a rod 6 which is rigidly secured on the plate 1 at one point 7 of said plate. Said rod may, for example, pass through the plate, said plate being provided for this purpose with a hole, and which may be locked on both sides of said plate by means of nuts 8. Point 7 is preferably off-centered with respect to the plate. Motor 5 of the loud-speaker being connected to the output of the electric musical instrument, the moving member of said motor vibrates at the frequency of the currents generated by said instrument. Said vibration is transmitted through rod 6 to plate 1 which is thus excited. The sound generated by the instrument for a given frequency sent to the loud-speaker motor is a complex sound, the fundamental frequency of which is the frequency of the current energizing said motor but which comprises various harmonic frequencies. As the frequency sent to the loud-speaker motor varies, the previous excitation of the plate still goes on during a certain period of time. There is thus obtained very original timbres.

In order to damp at a desired instant the vibration of the plate, there may be provided a felt

member 9 mounted, for example, on a support pivoted about a fixed point 10 and which may be pressed on the plate by the performer by pulling a control rod 11.

In the alternative embodiment shown in Figs. 3 and 4, the multi-resonator comprises vibrating metal, such as steel strings of different natural resonance frequencies. Said strings are tightened in two radial sets 11, 12 on both sides of a rigid frame 13 provided with pegs 14 and 15 by means of which the tightening of said strings may be adjusted. Frame 13 has the shape of a closed flat outline which may be a circular outline as shown in Fig. 4 or an oval outline and the strings are tightened between two points of said outline so that in each set they cross one another at a same point A and B respectively, points A and B being preferably symmetrically located relative to the frame. Through said crossing points A and B of the strings passes a rod or a tube 16 and the strings are tightened thereover. Frame 13 provided with its strings rests on a base 19 carrying a conventional loud-speaker motor 5 similar to the motor employed in Figure 2. The moving member of said motor is mechanically connected to the rod 16 through a rod 20.

It results from the above description that the vibrations of the moving member of the loud-speaker motor are transmitted to rod 16 and thence to the strings. From a current at sonic frequency exciting the loud-speaker motor, the string resonating to said frequency and the strings resonating to the natural harmonics of said frequency are directly set in vibration. The resultant thereof is a complex sound which is still audible during the decay of the vibration.

As shown in the drawing, the strings may be associated with a diaphragm 21, made of skin, for example, embedded at its edges in and tightened in frame 13, which may comprise, for example, two symmetrical parts clamped on both sides of the diaphragm. Near to the frame there may be provided small bridges 22, 23 through which strings 11, 12 bears upon diaphragm 21 to which they transmit their vibrations. Said bridges may be independent, one for each string, or several strings may rest simultaneously on one bridge.

Rod 16 passes through a hole 24 of the diaphragm and comprises preferably at this place a part 16a of reduced section so that the hole to be bored may be of a reasonable size.

Alternatively rod 16 may be rigidly secured to the diaphragm so that the vibrations may be transmitted directly to said diaphragm, in which case bridges 22, 23 may be omitted.

In order to ensure if desired a quick damping of the strings vibration there may be provided two felted rings 24, 25 movable coaxially toward the nut on two stationary cylindrical supports 26, 27. Springs 28, 29 hold said rings away from the strings and the performer may press them on the strings by actuating flexible controls 30, 31.

According to an alternative embodiment of the above device strings may be tightened only on one side of frame 13.

It will be seen that in Figs. 3 and 4, crossing points A and B of the strings are off-centered. Thus the same string may respond to two different frequencies with its shorter length for the high-pitched sounds and with its longer length for the low-pitched sounds. Now, instead of having a single string tightened between two points of frame 13 and running at an intermediate point on the rod 16, two string portions of different cross-sections could be secured at one end to the rod 16 and at the other end to the frame.

Another alternative embodiment would consist in tightening the strings but only on one side of a line CD (Fig. 5) which may be a straight line or a broken line and which crosses the rod at A. In this case, the resultant of the string tensions will be supported on the other side of said line by one or more flexible straps 30.

In each one of the embodiments above described the multi-resonator may be associated with one or more conventional loud-speakers the diaphragms of which would be actuated either by independent motors or by the same motor as the multi-resonator.

For operating the loud-speakers described, loud-speaker motors sufficiently powerful should be used. It seems preferable for this purpose to choose loud-speaker motors of the so-called magnetic type. In such motors the field may be moreover improved by substituting an electromagnet for the permanent magnet.

It is also to be understood that the embodiments described have been merely given as an illustration and that they could be modified, particularly by substitution of technical equivalents within the scope of my invention.

What I claim is:

1. An electrical sound generating device particularly intended for electric musical instruments and comprising a vibrating member with front and rear faces, two sets of vibrating strings arranged respectively over said faces, said vibrating member thereby being located between said sets of strings, a loudspeaker arranged to actuate said strings, and said strings being in vibratious transmitting relationship with said vibrating member to impart vibratory motion to said member.

2. A sound generating device as in claim 1 and a rigid frame having said vibrating member fastened thereto, and said strings being provided with means fastening the same to said frame.

3. A sound generating device as in claim 2 wherein said vibrating member has on at least one of the said faces thereof a bridge upon which at least some of said strings rest at points intermediate the ends of said strings.

4. An electrical sound generating device particularly intended for electric musical instruments and comprising a vibrating member with front and rear faces, two sets of vibrating strings arranged respectively over said faces, said vibrating member thereby being located between said sets of strings, a loudspeaker arranged to actuate said strings, said strings being in vibratious transmitting relationship with said vibrating member to impart vibratory motion to said member, a frame to which said vibrating member is fastened, said strings being attached to said frame, a movable member operatively connected with said loudspeaker, and said strings being connected with said movable member to receive vibratory motion from said loudspeaker.

5. The assembly of claim 4 and movable means arranged to be pressed on said strings for damping rapidly their vibrations.

6. The assembly of claim 1 and movable means arranged to be pressed on said strings for damping rapidly their vibrations.

7. An electrical sound generating device particularly intended for electric musical instruments and comprising a vibrating member with

front and rear faces, two sets of vibrating strings arranged respectively over said faces, said vibrating member thereby being located between said sets of strings, a loudspeaker arranged to actuate said strings, said strings being in vibratious transmitting relationship with said vibrating member to impart vibratory motion to said member, some of said strings running through a common point, and connecting means fastening said some of said strings at said common point to said loudspeaker so that said strings may derive vibratory motion from said loudspeaker.

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