Oct. 17, 1961 F. P. M. BASCHET 3,004,620

ACOUSTIC AMPLIFIER AND MUSICAL INSTRUMENT INCORPORATING SAME

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Fig.1

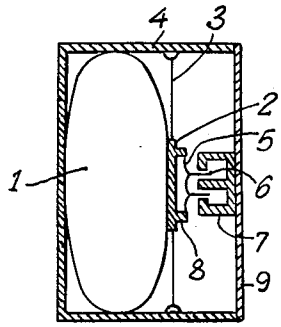


Fig.2

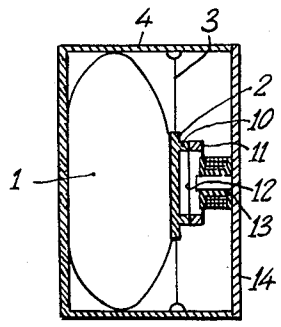


Fig.3

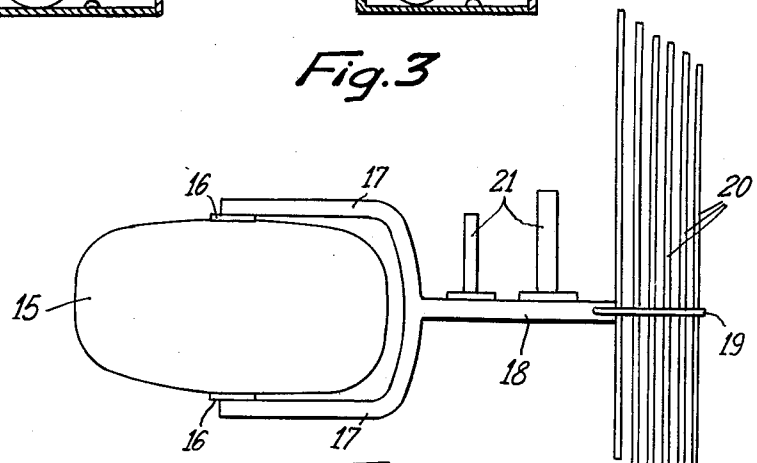
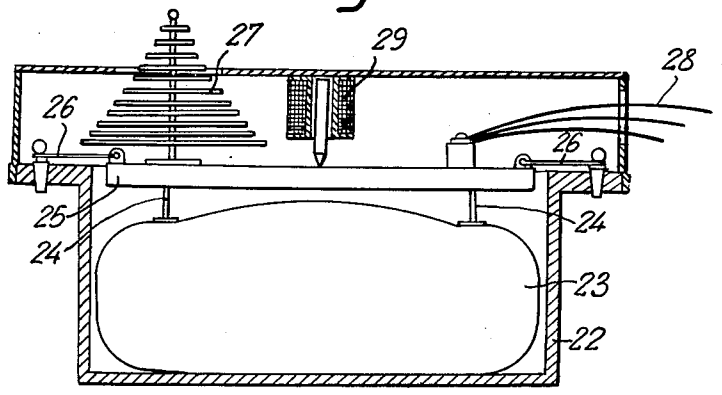


Fig.4



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ACOUSTIC AMPLIFIER AND MUSICAL INSTRUMENT INCORPORATING SAME

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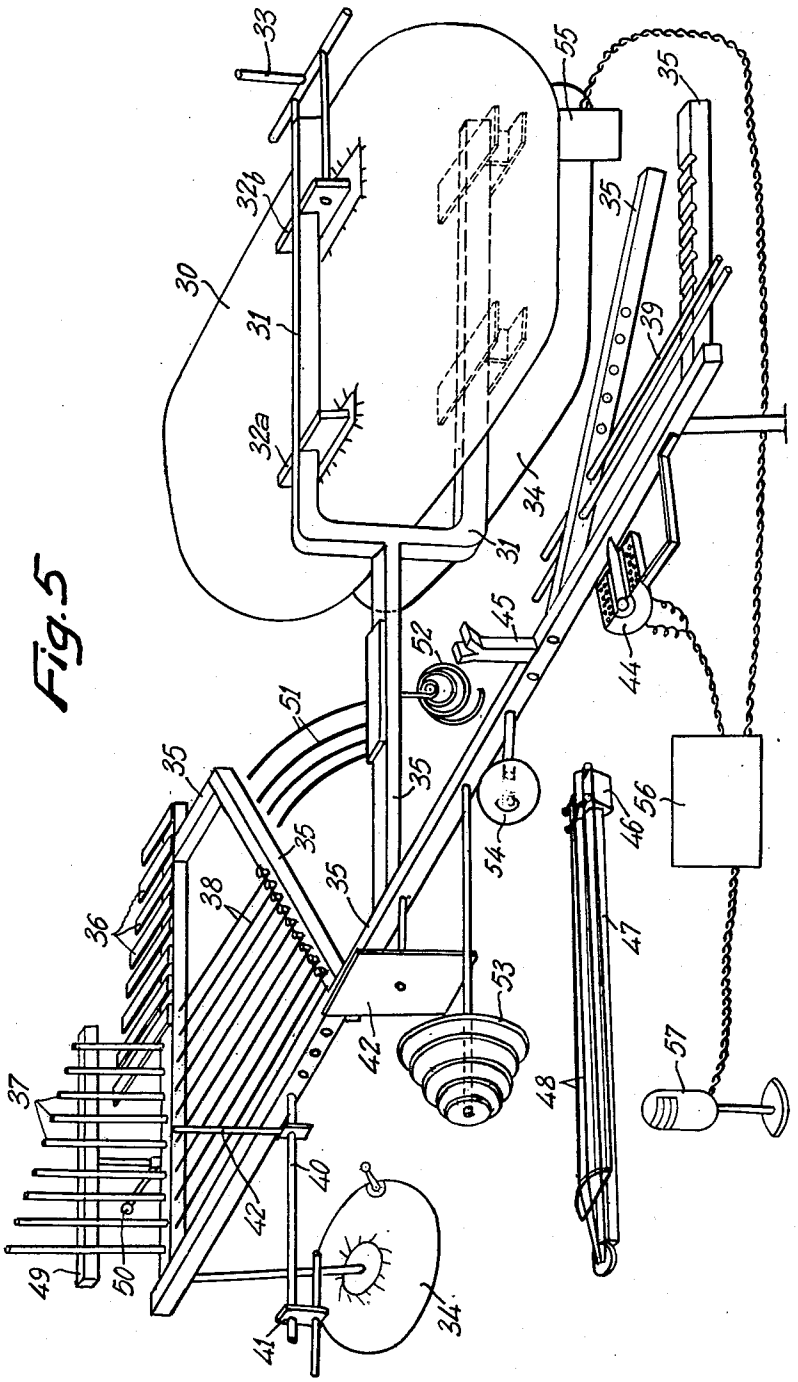
Fig. 5



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ACOUSTIC AMPLIFIER AND MUSICAL INSTRUMENT INCORPORATING SAME

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My invention has for its object an acoustic amplifier and its incorporation into musical instruments chiefly as a loud speaker for electronic apparatus and as a resonant amplifier for music instruments of a novel type.

Sound amplifiers, according to my invention, include at least one closed bag made of a yielding material inflated by means of a fluid, said bag engaging at least one shoe mechanically connected with at least one vibration generator.

The vibration generator may be constituted by the vibratory member of an arrangement such as the diaphragm of a magnetic loud-speaker, the winding of an electro-dynamic loud speaker or the recording point of an electromagnetic generator or again a mechanically vibrating element tuned to a predetermined frequency and constituted for instance by a bar, blade, string, plate, pipe, acoustic chamber or the like.

In the case of a plurality of acoustic amplifiers and/or of a plurality of generators of vibrations of the same nature or of different natures, associated to form an unitary apparatus, a stock made of a rigid material connects mechanically the system of amplifier shoes with the system of vibration generators.

The stock is constituted preferably by the rigid bars forming a channel for the transmission of vibrations from the generator or generators to the shoe or shoes.

It is also possible to fit on the stock between the generators, resonators which vibrate through mechanical resonance, when their natural period corresponds with the frequency induced inside the stock by the main generator or generators.

Further features and advantages of my invention will appear in the reading of the following description of various embodiments of my invention as described hereinabove, reference being made to the accompanying drawings wherein:

FIG. 1 is a diagrammatic cross-section of an electrodynamic loud speaker.

FIG. 2 is a diagrammatic cross-section of a magnetic loud-speaker.

FIG. 3 is an elevational view of a simple instrument operating through percussion.

FIG. 4 is a diagrammatic view of an apparatus incorporating a vibration generator and mechanical resonators.

FIG. 5 is a general digrammatic view of an apparatus including a multiplicity of mechanical and electronical generators associated with various resonators.

Turning to FIGS. 1 and 2, the loud-speaker illustrated therein is constituted by an amplifier according to my invention, including a bag 1 of plastic material, preferably polyvinyl chloride, said bag being filled with air or the like fluid.

A rigid shoe 2 engages the wall of the bag and is held in position by stays 3, preferably stays having no natural

vibratory frequency within audible range, said stays holding the bag inside the outer box or frame 4.

In the embodiment of FIG. 1, the shoe 2 is rigidly secured to the diaphragm 5 carrying the movable coil 6 forming part of the electrodynamic driving unit 7 of the loud-speaker through the agency of an annular series of pillars or of a solid peripheral annulus 8.

The core of the electro-dynamic loud-speaker is secured to the rear wall 9 of the container 4. The coil 6 and the diaphragm 5 form the vibration generator and their vibrations are transmitted through the pillars 8 and the shoe 2 to the bag 1 which matches and amplifies them.

In the embodiment illustrated in FIG. 2, the shoe 2 holds between the annulus 10 rigid therewith and a clamping ring 11, the periphery of the iron diaphragm 12 forming the movable member of a magnetic loud-speaker the coil 13 of which is rigidly secured to the rear wall 14 of the box or frame 4.

I have described with reference to FIGS. 1 and 2 the vibration generating members as positioned outside the bag 1, but said members may be mounted inside the bag, provided fluid tightness is insured for the latter in register with the passage afforded for the supports required for carrying such generating members.

The above embodiments may also be used as microphones, the bag providing for the reception of the sound waves and their transformation into vibrations of the coils or diaphragms which in their turn produce modulated electric currents.

The embodiment illustrated in FIG. 3 constitutes a music instrument of a novel type. It includes an inflated casing or bag 15 held between two shoes 16 facing opposite sides of the bag and rigidly secured to corresponding arms 17 of a forked member forming a part of the stock. The fork includes a carrier bar 18 for the arms 17 the outer end of which bar is rigid with a semicircular plate 19 to which are secured rods 20 of different lengths. These rods have lengths which are calculated so as to produce vibratory frequencies corresponding to musical frequencies. To the carrier bar 18 are also secured transverse rods 21 which are more rigid than the rods 20.

When the operator hits the rod 20 with a mallet, he starts the latter vibrating and the vibratory waves transmitted by the carrier bar 18, the fork 17 and the shoes 16 are matched and amplified by the bag 15 which provides for the transformation of the mechanical energy into acoustic vibrations, the frequency of which corresponds with that of the vibrations of the particular rod 20 which has been hit. The rods 21 which have no natural frequency of vibration produce, when hit, a noise similar to that produced by a drum.

The apparatus illustrated in FIG. 4 is of the type including an electronic vibration generator associated with mechanical resonators. Said apparatus includes a frame 22 inside which is housed a bag 23 of polyvinyl chloride engaged by a metallic mass 25 forming a stock with the interposition of supports 24 having a T-shaped cross-section. The stock 25 is held in position by stays 26 constituted for instance by means of stretched strings of musical instruments having a well-defined natural frequency of oscillation.

The stock carries a series of superposed vibratory plates 27 the sizes of which are selected so as to produce vibra-

tions at predetermined musical frequencies. The stock carries also rods 28 made of sections of piano wire having also natural periods of vibration at well determined frequencies. The generator of acoustic vibrations is constituted by a loud speaker driving unit 29.

The loud-speaker driving unit 29 generates inside the stock 25 vibrations which are transmitted through the supports 24 to the bag 23 and are matched by the latter through transformation of the mechanical energy into acoustic waves of a considerable intensity, which are transmitted to the strings 26, to the plates 27 and to the rods 28. Of these strings, plates and rods those which are tuned to the acoustic waves thus produced are in resonance and their natural vibrations are transmitted to the bag 23 and are amplified by the latter so as to produce an acoustic echo.

The principles underlying the above-described apparatus are to be found again in the music instrument illustrated in FIG. 5. The latter includes as a main component member a bag 30 fitted inside a fork 31 with the interposition of supports 32*a*, 32*b*, which produce a mechanical connection between the bag and the fork. It has been found that the size of the bearing surfaces for the supports furthers selectively the transmission of sharp sounds when said bearing surfaces are sufficiently broad and reversely. Consequently, according to a preferred feature of the apparatus, the supports have bearing surfaces of different shapes and sizes while pedals such as 33 allow disconnecting one or more supports so as to further the selective transmission of sharp and deep sounds. Further bags 34 may also be incorporated with the instrument, for instance as illustrated underneath the latter so as to serve both as auxiliary feet and as auxiliary amplifiers.

The fork 31 which may form a tuning fork extends outwardly in the shape of a stock constituted by a system of metal bars 35 forming a unit which is as rigid and homogeneous as possible so as to cut out any undesired natural frequency of vibration. The stock 35 forms simultaneously the frame, the carrier and the channel for transmitting the vibratory waves produced by the different generators. The vibration generators illustrated include a set of blades 36, a set of vibrating bars 37, a set of strings 38, a set of bars 39 adapted to be actuated through plucking or percussion, a set of vibratory bars 40 the frequency of which is adjustable through corresponding counterweights 41 and energized through friction exerted on a glass rod 42, secured to each of them, vibratory plates 43 energized through friction of a bow on their edges and an electronic generator 44 of the type referred to hereinabove and the principle of operation of which will be disclosed hereinafter. The apparatus described includes also a bearing support 45 cooperating with a wedge 46 or the like, said wedge 46 being provided on an independent vibration generator such as the neck of a violin or guitar over which are stretched strings 48.

Dampers or the like sound modifying members 49 may be provided for cooperating with one or more of the above described vibration generators. These members are operated through pedals such as 50. Lastly, the instrument is provided with resonators such as rods made of piano wires 51, a spirally wound piano wire 52, vibratory plates 53, resonant spheres 54, etc.

The instrument described may also include advantageously a generator of electronic vibrations 55 which operates directly the amplifier constituted by the bag 30 simultaneously with or independently of the generator 44 under the control of a common electronic amplifier 56 and of a microphone 57. Said generator 55 allows amplifying in a pure manner the human voice without any interference through the resonator of the instrument.

As a matter of fact, when the electronic generator 44 or any of the generators 36 to 43 is energized, these component parts of the other generators or these resonators 51 to 54 which have a period in phase with the generator considered, vibrate at their natural frequency and produce thus the effect of an echo. To obtain a pure amplification of the vibrations corresponding solely to microphonic currents, it is therefore necessary to resort to the electronic generator 55 which is mechanically independent of the stock.

Obviously, the above-described embodiments are adapted to be modified in various manners without widening unduly the scope of the present invention as defined in the accompanying claims.

What I claim is:

1. A musical instrument comprising at least one inflatable, freely expansible bag of yielding material, a mass of fluid material filling said bag, shoes positioned at opposite sides of said bag, a rigid metal fork for said bag the arms of which embrace the bag and are rigidly secured to said shoes, a rigid metal core attached to said fork and a set of tuned metal rods adapted to vibrate, said tuned rods having one of their ends fitted in said metal core, the mass of which is such that it is incapable of assuming any substantial vibratory shifting in space under the action of the vibrations of the vibrating rods and that it forms a vibration node for the vibrations of said vibrating rods at their ends fitted in the core.

2. A musical instrument comprising at least one inflatable, freely expansible bag of yielding material, a mass of fluid material filling said bag, shoes positioned at opposite sides of said bag, a rigid metal fork for said bag the arms of which embrace the bag and are rigidly secured to said shoes, a rigid metal core attached to the said fork and a set of tuned metal rods adapted to vibrate, said tuned rods having one of their ends fitted in said metal core, the mass of which is such that it is incapable of assuming any substantial vibratory shifting in space under the action of the vibrations of the vibrating rods and that it forms a vibration node for the vibrations of said vibrating rods at their ends fitted in the core and at least one of a plurality of echo-producing resonating members rigidly secured to the core.

3. A musical instrument comprising at least one inflatable, freely expansible bag of yielding material, a mass of fluid material filling said bag, shoes positioned at opposite sides of said bag, a rigid metal fork for said bag the arms of which embrace the bag and are rigidly secured to said shoes, a rigid metal core attached to the fork and a set of tuned metal rods adapted to vibrate, said tuned rods having one of their ends fitted in said metal core, the mass of which is such that it is incapable of assuming any substantial vibratory shifting in space under the action of the vibrations of the vibrating rods and that it forms a vibration node for the vibrations of said vibrating rods at their ends fitted in the core and at least one set of resonating plates carried by the core and adapted to vibrate through mechanical resonance with the tuned metal rods.

4. A musical instrument comprising at least one inflatable, freely expansible bag of yielding material, a mass of fluid material filling said bag, shoes positioned at opposite sides of said bag, a rigid metal fork for said bag the arms of which embrace the bag and are rigidly secured to said shoes, a rigid metal core attached to the fork and a set of tuned metal rods adapted to vibrate, said tuned rods having one of their ends fitted in said metal core, the mass of which is such that it is incapable of assuming any substantial vibratory shifting in space under the action of the vibrations of the vibrating rods and that it forms a vibration node for the vibrations of said vibrating rods at their ends fitted in the core, each vibrating rod carrying a glass rod secured perpendicularly to said rod and adapted upon energization to generate vibrations in said corresponding vibrating rod.

5. A musical instrument comprising an inflated bag of yielding material, a fork-like member having a carrier bar and at least two arms, said arms embracing said bag and having shoe means on terminal portions thereof engaging

opposite sides of said bag, and a vibrator operatively connected to said carrier bar, whereby when said vibrator is set into vibration the resulting vibrations are transmitted through said arms to said bag.

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