United States Patent

[11] **3,527,134**

[72] Inventor **Shuji Muraki**
Hamamatsu-shi, Japan

[21] Appl. No. **818,482**
[22] Filed **April 23, 1969**
[45] Patented **Sept. 8, 1970**

[73] Assignee **Nippon Gakki Seizo Kabushiki Kaisha**
Hamamatsu-shi, Shizuoka-ken, Japan
a corporation of Japan

[54] **PEDAL KEY ASSEMBLY OF AN ELECTRONIC MUSICAL INSTRUMENT**
6 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **84/366,** 84/426, 84/444
[51] **Int. Cl.** **G10b 3/10,** G10c 3/12
[50] **Field of Search** 84/366, 426, 444, 433, 436, 353

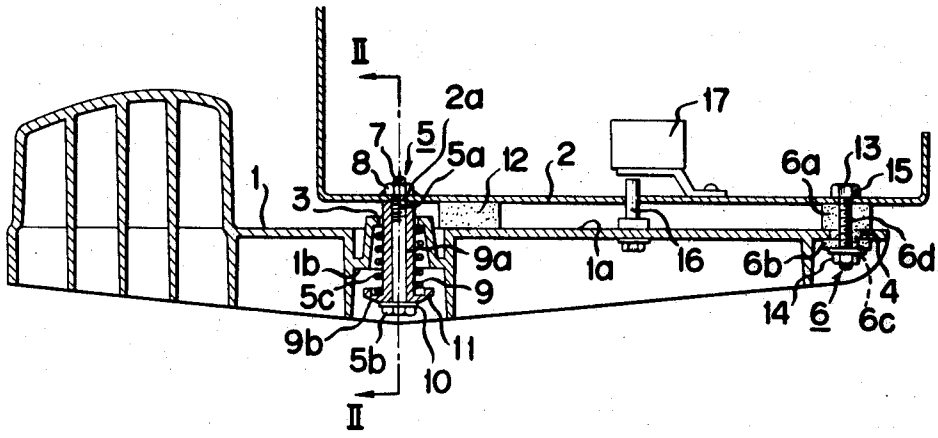
[56] **References Cited**

UNITED STATES PATENTS

2,499,244	2/1950	Hammond et al.	84/426
3,295,402	1/1967	Klann	84/366

Primary Examiner—Stephen J. Tomsky
Assistant Examiner—John F. Gonzales
Attorney—George B. Oujevolk

ABSTRACT: A plurality of parallel arranged pedal key members are individually swingable on a vertical plane and floatingly supported by the corresponding suspension members downwardly extending from the bottom frame of a musical instrument body.



Patented Sept. 8, 1970 3,527,134

FIG. 1

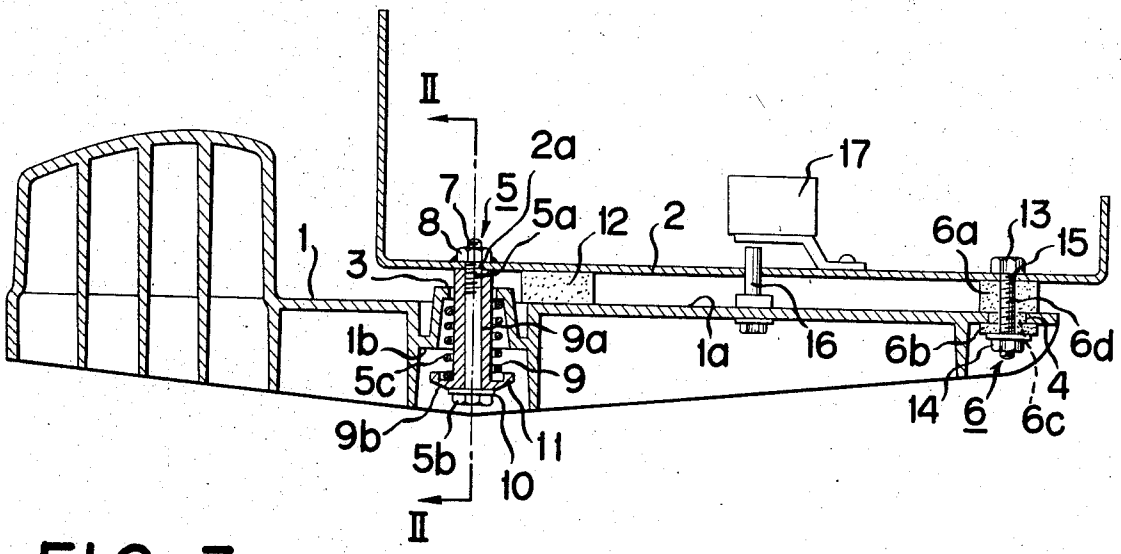


FIG. 3

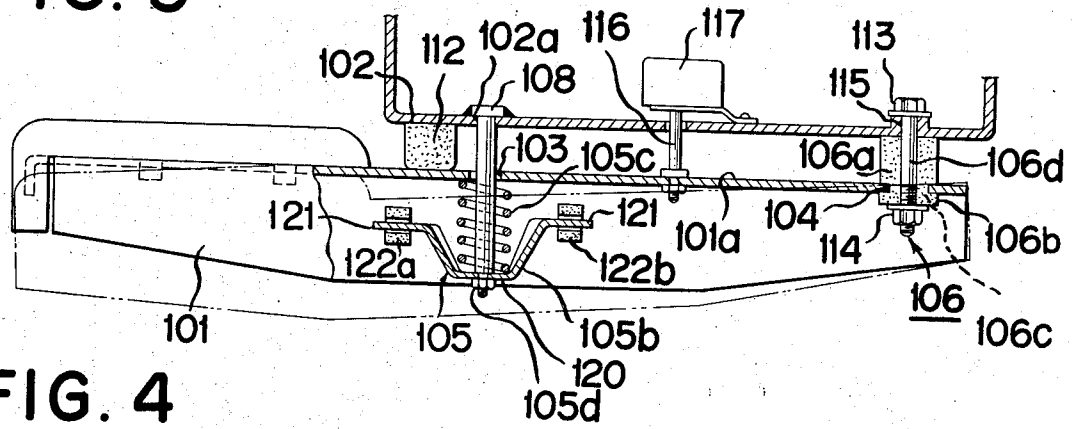
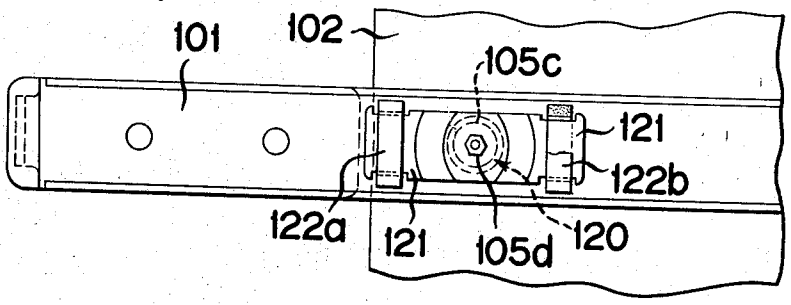


FIG. 4



Shinji Murata
INVENTOR.

BY George B. Oujevolk
Attorney

FIG. 2

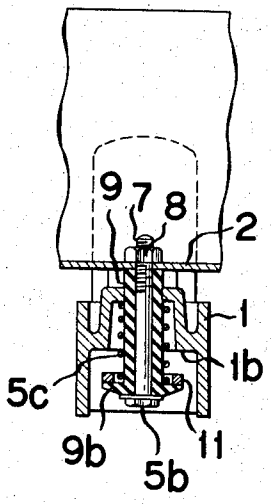


FIG. 5

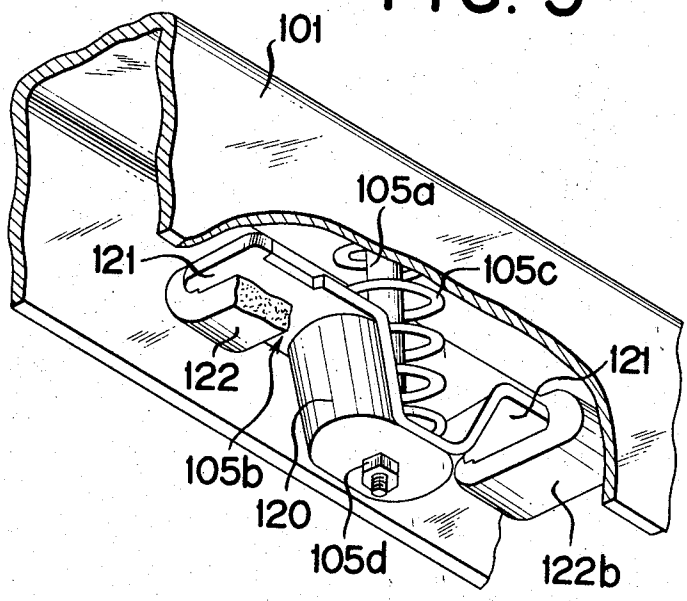


FIG. 7

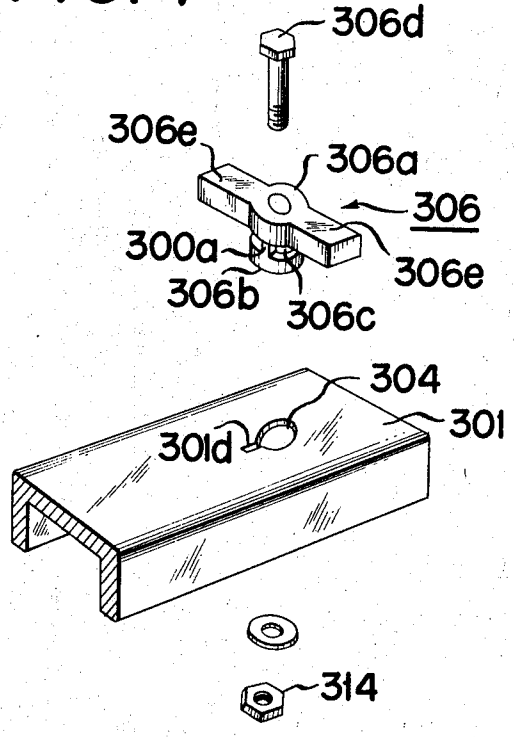
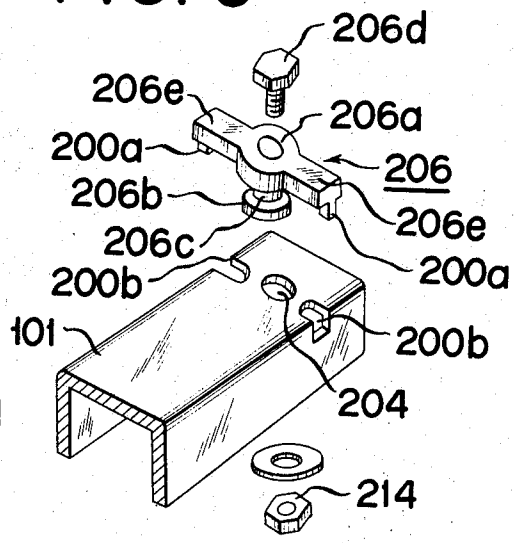


FIG. 6



Shinji Imaeda
INVENTOR.

BY Henry B. Cuprosch
Attorney

PEDAL KEY ASSEMBLY OF AN ELECTRONIC MUSICAL INSTRUMENT

BACKGROUND OF THE INVENTION

This invention relates to a pedal key assembly of an electronic musical instrument and more particularly to an improvement of suspension mechanisms for supporting pedal key members.

The prior art suspension mechanisms are mainly disposed in the musical instrument body and fabricated in such a manner that only the supporting bar of each of said suspension mechanisms extends out from the bottom of said instrument body and is connected to the corresponding pedal key member.

Since the main part of the suspension mechanism is located in the instrument body, it is very difficult to adjust the urging force for lifting the key member to the upper limit of its movement while pushing down the corresponding key member, to assemble said suspension mechanism with the key member in such a manner that all the key members are arranged on a common level, and to inspect and, if necessary, repair the assemblies of the key members and suspension mechanisms.

SUMMARY OF THE INVENTION

An object of this invention is to provide a pedal key assembly improved to eliminate the above-mentioned defects.

The pedal key assembly of this invention wherein there are provided a plurality of parallel arranged key members under the bottom frame of an instrument body, each having a suspension member and a pivotally fitting member at which the key member is swingable on a vertical plane, is characterized in that said suspension member involves a supporting bar downwardly extending from the bottom frame and penetrating the key member, a stop member located at the lower portion of said supporting bar so as to define the limit of the downward movement of said key member, and a compression spring member interposed between the key member and the stop member so as upwardly to urge the key member.

In this case, a space in the instrument body which, according to the prior art, has been occupied by the suspension mechanisms can be fully utilized by disposing therein switch elements corresponding to the pedal key members.

BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a vertical cross sectional view of a pedal key assembly embodying this invention;

FIG. 2 is a cross sectional view of said pedal key assembly taken along a line II—II of FIG. 1;

FIG. 3 is a vertical cross sectional view of a pedal key assembly according to another embodiment of the invention;

FIG. 4 is a plan view of said pedal key assembly of FIG. 3 shown from the underside;

FIG. 5 is a fragmental perspective view of said pedal key assembly of FIG. 3;

FIG. 6 is an exploded perspective view of a pivotally fitting member involved in said pedal key assembly of the above-mentioned embodiments; and

FIG. 7 is an exploded perspective view of a pivotally fitting member modified from that of FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the pedal key assembly of this invention is indicated in FIGS. 1 and 2. Said pedal key assembly is provided with a plurality of pedal key members 1 parallel arranged under the bottom frame 2 of an electronic musical instrument body. Each of said key members 1 consists of an inverted channel-shaped member or rigid plastic material such as rigid synthetic resin, and has a circular aperture 3 formed on the upper wall 1*a* thereof at the approximately middle portion of the length of the key member, and an aperture 4 formed on the same wall 1*a* at the rear end portion thereof.

Said pedal key assembly further involves a suspension member 5 and a pivotally fitting member 6 which correspond to each of the pedal key members 1. Said suspension member 5 consists of a supporting bar 5*a*, a stop member 5*b*, and a compression spring member 5*c*. Said supporting bar 5*a* downwardly extends from the bottom frame 2 and penetrates the key member 1 in a manner loosely to pass through said aperture 3. The lower terminal end of said supporting bar 5*a* is positioned in the channel of said key member 1. To the lower terminal end of said supporting bar 5*a* is attached said stop member 5*b*. In this arrangement, said stop member 5*b* preferably consists of a hexagonal head integrally formed with the lower end of said supporting bar 5*a*. Said supporting bar 5*a* has a screw 7 threaded on the upper periphery thereof. The upper portion of said supporting bar 5*a* passes through a bore 2*a* formed in the bottom frame 2 so that said screw is securely set in place by a hexagonal nut 8 carried or welded on the bottom frame 2. A hollow cylindrical member 9 made of synthetic resin is interposed between the frame 2 and stop member 5*b*, and loosely passes through the circular aperture 3. Said member 9 has a hollow portion 9*a* through which the supporting bar passes to be covered with said member 9. Said member 9 further has a disk 9*b* integrally formed therewith and superposed on the upper peripheral portion of said stop member 5*b* by the medium of washer 10.

The above-mentioned compression spring member 5*c* is preferably formed into a coil in a manner loosely to surround the cylindrical member 9, and interposed between the disk 9*b* and the portion of the key member 1 defined around the circular aperture 3.

The suspension member 5 additionally involves an annular member 11 superposed on the peripheral portion of the disk 9*b*. In order to limit the movement of the key member by the stop member 5*b* when said key member is downwardly pushed, said key member is provided with an annular seat 1*b* formed under the aperture 3 in a manner to face said annular member 11 disposed on the stop member 5*b* in a vertical direction. Said annular member 11 is preferably made of a shock absorbing material such as felt or rubber so as silently to contact the seat 1*b* even when the key member 1 is roughly operated.

For the same purpose of eliminating the noises to be caused, between the key member 1 and bottom frame 2, there is attached by adhesives to either one thereof a shock absorbing member 12 made of foamed synthetic resin or rubber.

The pivotally fitting member 6 indicated in this embodiment consists of a body 6*a* of elastic material such as rubber having a disk 6*b* integrally formed with the lower end thereof and an annular groove 6*c* for engagement with the aperture 4 defined between the disk 6*b* and the lower surface of the body 6*a*, and a bar member 6*d* for supporting said body downwardly extending from the bottom frame 2. Said bar member preferably consists of a bolt having a hexagonal head 13 formed at the top thereof, and a nut 14 screwed by a threaded portion formed at the lower portion thereof. Said bar member 6*d* downwardly extends through a bore 15 drilled in the bottom frame 2 with its head 13 carried on the bottom frame 2. Said body 6*a* is interposed between the bottom frame 2 and the rear end portion of the key member 1 by engaging the groove 6*c* with the aperture 4. In this case, the space between the bottom frame 2 and the rear end portion of the key member 1 is adjusted by advancing or retreating the nut 14 engaged with the screwed portion of said bar member 6*d* in a manner elastically to deform the body 6*a*, whereby the adjacent key members 1 are aligned on a common horizontal level. Mounted on the key member 1 is an operating member 16 which is vertically moved with the movement of said key member 1. A keying switch mechanism 17 corresponding to said operating member is mounted on the bottom frame 2. Said operating member 16 penetrates the bottom frame 2 and has its top facing the element of said switch mechanism to be switched.

In operation, when the key member is pushed down, it is brought to the lower limit of its movement against the urging

force of the compression spring member **5***c* so that the key member is swung around the axis defined by the pivotally fitting member **6** due to the deformation of the body **6***a* caused by the movement of said key member. In this case, any occurrence of frictional or shock noises can be avoided between the key member and the suspension member or pivotally fitting member, because the key member contacts only the elastic member **11** or the elastic body **6***a*.

When the depressing force of the foot is removed from the key member **1** said key member **1** returns to the upper limit of its movement defined by the cushion piece **12** due to the urging force of the compression spring member.

In this embodiment, since the suspension mechanism is located at the outside of the instrument body, it is very easy to adjust the urging force for lifting the key member to the upper limit of its movement while pushing down the corresponding key member, to assemble said suspension mechanism with the key member in such a manner that all the key members are arranged on a common level, and to inspect and, if necessary, repair the assemblies of the key members and suspension members. The arrangement of the key members on a common level is ensured by adjustment of the pivotally fitting members as described above. Furthermore, a space in the instrument body which, according to the prior art, has been occupied by the suspension mechanisms is emptied so that it can be fully utilized by disposing therein switch elements corresponding to the pedal key members and relative electrical component.

FIGS. **3** to **5** indicate another embodiment of this invention. In this embodiment, a suspension member **105** particularly consists of a supporting bar **105***a*, a stop member **105***b*, a compression spring member **105***c* and a hexagonal nut **105***d*. The upper portion of said supporting bar **105***a* passes through a bore **102***a* formed on a bottom frame **102** and a head **108** integrally formed with said upper portion is welded on the bottom frame **102**. The stop member **105***b* consists of a cup-shaped portion **120** with its sides cut off and opposite wings **121** integrally formed with said cup-shaped portion in a manner to extend therefrom in the lengthwise direction of a key member **101**. Said stop member **105***b* further involves two contact elements **122***a* and **122***b* made of shock absorbing material such as foamed synthetic resin or rubber and at least covering said wings **121** respectively. Said contact elements **122***a* and **122***b* are annularly formed and surround the wings **121** respectively. Said cup-shaped portion **120** is carried on the nut **105***d* adjustably screwed into the threaded portion of the supporting bar **105***a*. The compression spring member **105***c* is formed in the same manner as described in the first embodiment and interposed between the upper wall **101***a* of the key member **101** and the cup-shaped portion **120** of the stop member.

The remaining parts except those described above are shown in the corresponding figures by the reference numerals having the same digits in the first and second places as those used in the first embodiment, and are omitted from description for avoiding the complicated explanation.

The pedal key assembly of this second embodiment is operated with substantially the same technical effect as described in the first embodiment. In addition, since the parts of contact elements **122***a* and **122***b* are permitted to face the inner side walls of the key member **101**, the key member **101** when operated is prevented from being displaced in its transverse direction by contacting the stop member through the medium of contact elements, and is also kept free from frictional or shock noises due to the elastic quality of said contact elements.

FIGS. **6** and **7** indicate two modifications of a pivotally fitting member from the first embodiment. The pivotally fitting member **206** shown in FIG. **6** involves a body **206***a*, a disk **206***b*, an annular groove **206***c* and a bar member **206***d* of the same type as in the case of the first embodiment. Furthermore, said pivotally fitting member **206** encloses wings **206***e* extending from the sides of the body **206***a* in a transverse direction of the key member and whose lower surfaces are aligned with a plane involving the lower surface of the body, so that said wings contact the upper surface of the key member. Said wings **206***e* act to prevent the key member from being rolled around its lengthwise axis.

Each of said wings **206***e* preferably includes a convex portion or protrusion **200***a* integrally formed therewith on the under surface, and said key member includes a concave or cut portion **200***b* formed therewith to fit in with said convex portion or protrusion.

The pivotally fitting member **306** shown in FIG. **7** is not provided with a convex portion or protrusion like that **200***a* of FIG. **6**, but a projection **300***a* together with separate parts like those indicated in FIG. **6**. Said separate parts are shown in FIG. **7** by the reference numerals having the same digits in the first place and characters suffixed thereto as used in the embodiment of FIG. **6**. Said projection **300***a* is disposed in the groove **306***c* in a manner to bridge the body **306***a* and disk **306***b*. In this case, a key member **301** has a cut-off portion **301***d* formed on the edge of an aperture **304** in a manner to communicate with said aperture, thereby to fit in with said projection **300***a*.

The convex and concave portions in FIG. **6** or projection **300***a* and cut-off portion **301***d* are used to prevent the wings **206***e* or **306***e* from being rotated around the axis of the bar member **206***d* or **306***d*.

I claim:

1. A pedal key assembly of an electronic musical instrument comprising a plurality of parallel arranged key members under the bottom frame of an instrument body, each having a suspension member and a pivotally fitting member at which the key member is swingable on a vertical plane, characterized in that said suspension member involves a supporting bar downwardly extending from the bottom frame and penetrating the key member, a stop member located at the lower portion of said supporting bar so as to define the limit of the downward movement of said key member, and a compression spring member interposed between the key member and the stop member so as upwardly to urge the key member.

2. A pedal key assembly claimed in claim **1** in which said key member comprises a channel-shaped member, and said stop member is disposed in said key member and involves contact elements made of shock absorbing material and a least covering the parts of said stop member facing the upper wall of said key member.

3. A pedal key assembly claimed in claim **1** in which said key member involves a vertical aperture formed at the rear end thereof, and said pivotally fitting member comprises a body of elastic material having a disk integrally formed with the lower end thereof and an annular groove for engagement with said aperture defined between the disk and the lower surface of the body, and a bar member for supporting said body extending from the bottom frame of the instrument body downwards.

4. A pedal key assembly claimed in claim **3** in which said body of the pivotally fitting member includes wings extending from the sides thereof in a transverse direction of the key member and whose lower surfaces are aligned with a plane involving the lower surface of the body, thereby to cause said wings to contact the upper surface of said key member, and said bar member penetrates said body at its center.

5. A pedal key assembly claimed in claim **4** in which each of said wings includes a convex portion integrally formed therewith on the under surface, and said key member includes a concave portion formed therewith to fit in with said convex portion.

6. A pedal key assembly claimed in claim **4** in which a projection is disposed in the annular groove of the pivotally fitting member and a cut-off portion is formed on the edge of the aperture at the rear end of the key member to fit in with said projection.