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Aliprandi

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[54] **KEYBOARD FOR MUSICAL INSTRUMENTS WITH INERTIAL EFFECT OF THE KEYS**

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[21] Appl. No.: **474,261**

[52] **U.S. Cl.** **84/433;** 84/DIG. 7

[51] **Int. Cl.** **G10c 3/12**

[58] **Field of Search** ..... 84/1.01, 1.04, 1.06, 1.09, 84/1.1, 1.27, DIG. 7, 423, 424, 433–437; 200/248, 252, 254, 255, 258, 260, 250

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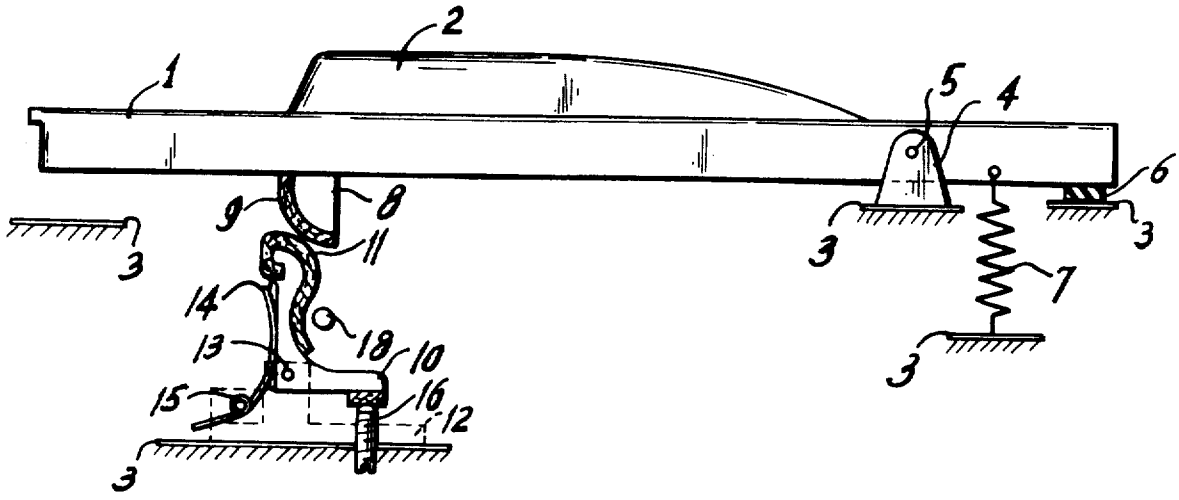
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Assistant Examiner—Stanley J. Witkowski

[57] **ABSTRACT**

A mechanical system for keyboards of any type of piano-like musical instrument of the reed, electric, electromagnetic or electronic variety. The system comprises a lever, with a pivot in its lower part, a lever support which is integral with the structure of the keyboard, and an appendix, provided on the lower face of the key, said lever and said appendix being arranged such that, by pressing the key, said lever and said appendix come into contact with each other, first by freely falling and then sliding one onto the other, thus opposing by friction a certain amount of resistance to the descent of the key.

12 Claims, 11 Drawing Figures



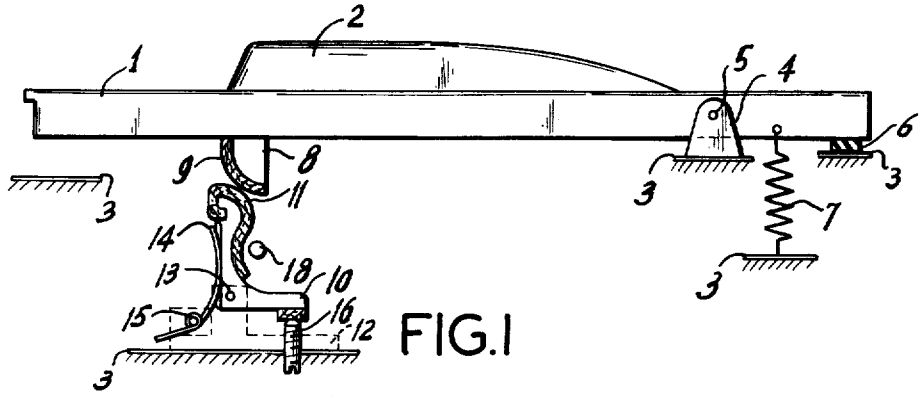


FIG.1

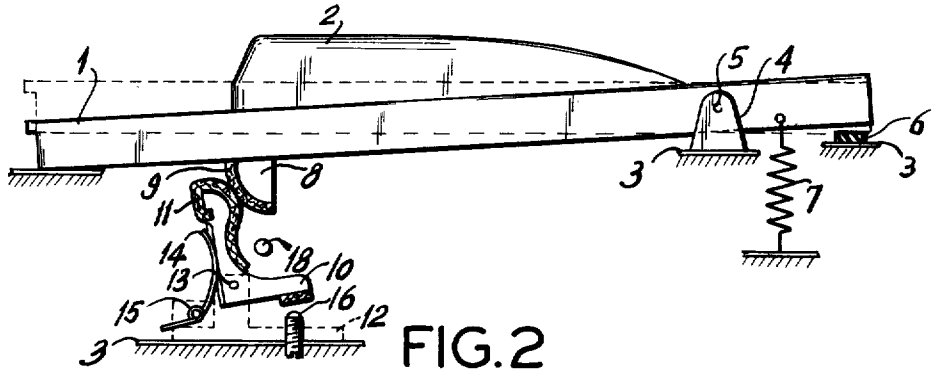


FIG.2

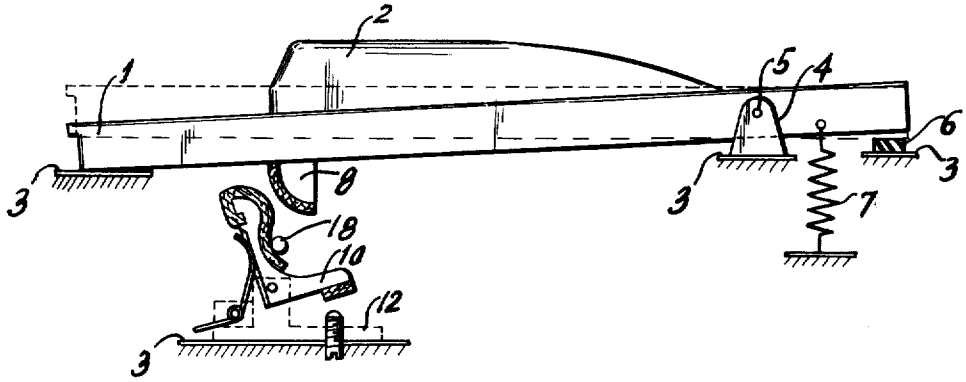


FIG.3

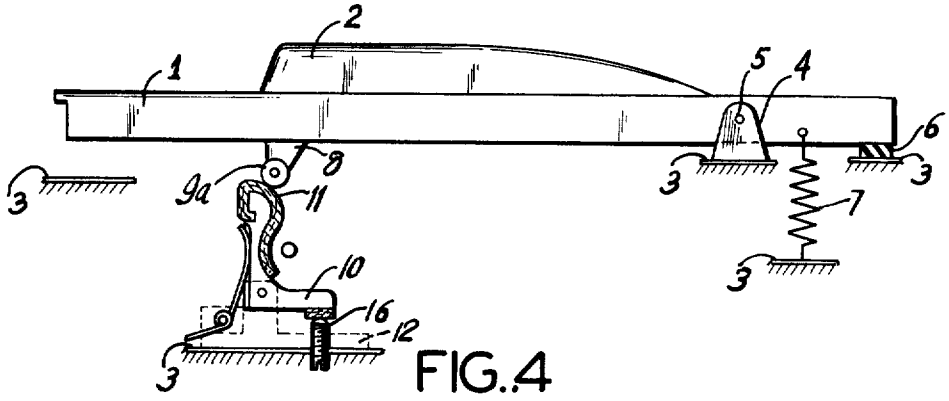


FIG.4

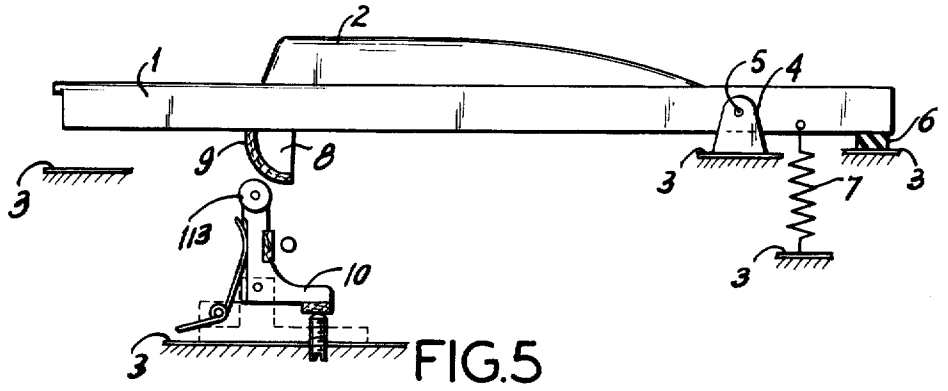


FIG.5

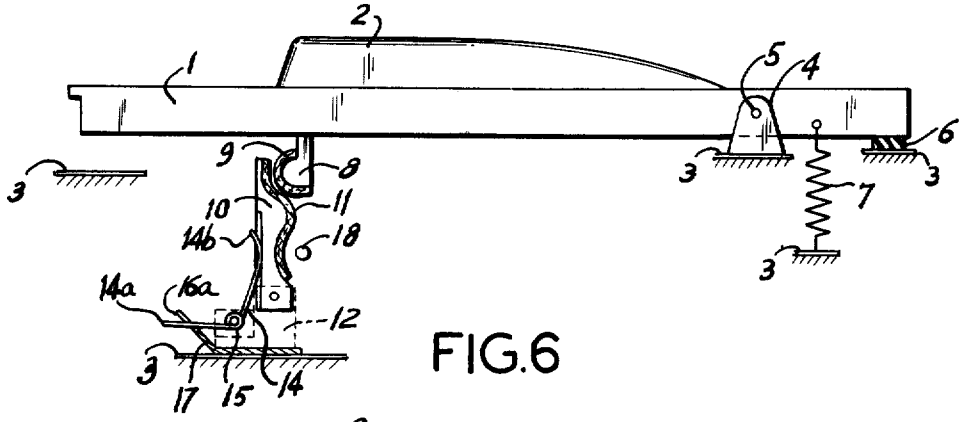


FIG.6

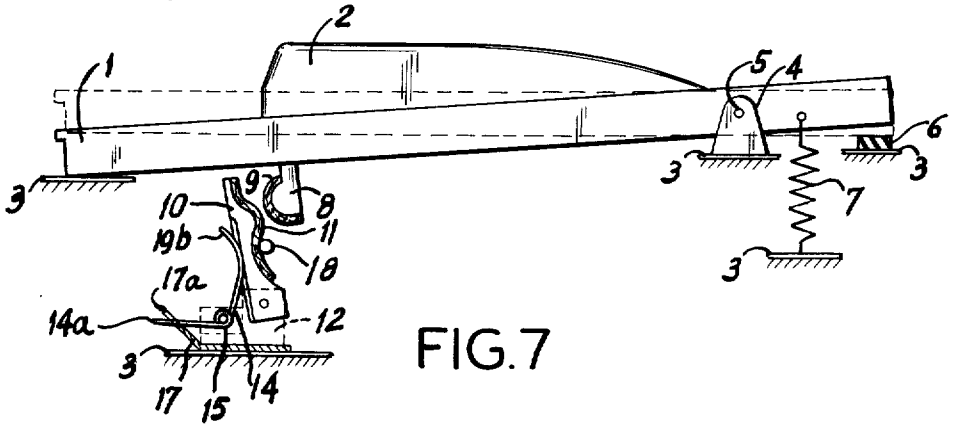


FIG.7

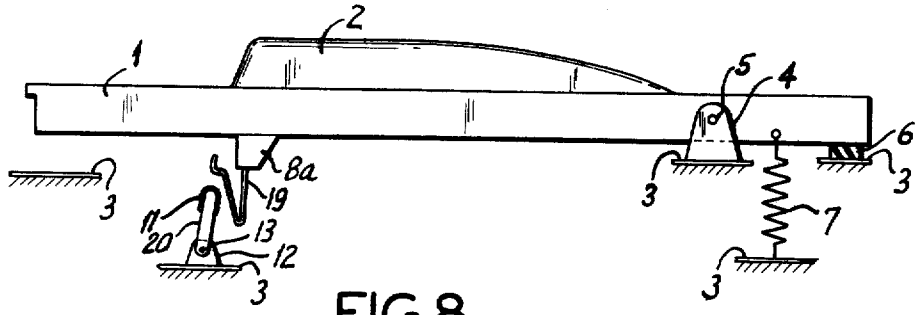


FIG.8

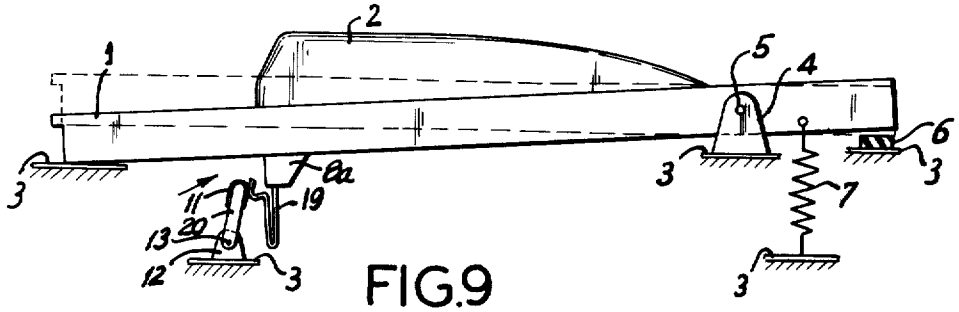


FIG.9

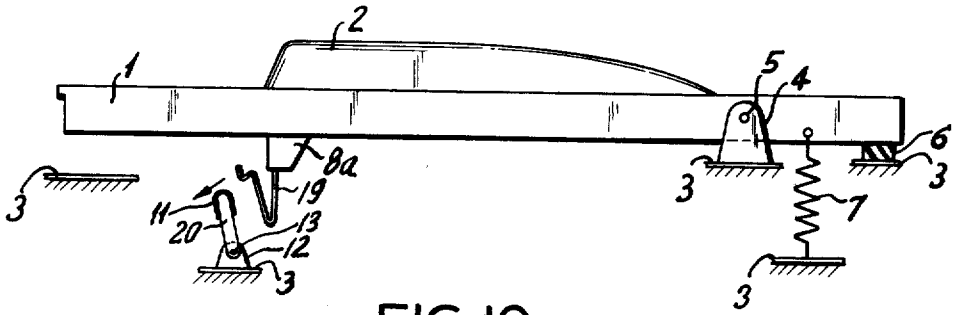


FIG.10

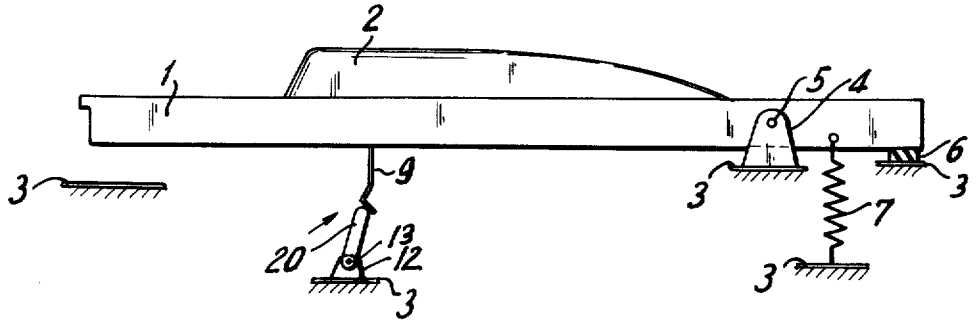


FIG.11

KEYBOARD FOR MUSICAL INSTRUMENTS WITH INERTIAL EFFECT OF THE KEYS

This invention concerns a mechanical system for the keyboard of piano-like musical instruments of the reed, electric, electromagnetic or electronic type, said system being apted to produce an inertial dynamic effect of the keys, similar to the effect obtained through the mechanics of the traditional pianos.

When pressing the keys of a traditional piano, there is a feeling of inertia due to the weight of the hammer and the other mechanical parts in movement and a dynamic feeling of sliding between the coupled parts of the mechanical system; this feeling is absent when pressing the keys of the piano-like keyboards usually employed for pianolas, organs, electric or electronic pianos or the like, wherein each key is joined to a fulcrum lever which is constantly biased by a counteracting spring which returns the lever to its resting position.

Keyboards having a mechanics of this ladder type give to the touch a feeling which is completely different from that given by traditional pianos, and, therefore, a piano player changing from a traditional piano to reed, electric, electromagnetic or electronic instruments, meets with a difficult adjustment and is unable to play in his customary way.

A mechanical system is known, based on hammers, levers and the like, which gives an inertial dynamic effect for the keyboards of the electronic instruments, but this system is complex and furthermore does not allow for the same keyboard to be played selectively, either with or without the abovementioned dynamic effect, thus limiting the field of exploitation.

The object of the present invention is to provide a mechanical system for piano-like keyboards of any type of musical instrument of the reed, electric, electromagnetic or electronic variety, the system allowing to play at will, with the same keyboard, either with or without the inertial dynamic and sliding effect, similar to the effect which is obtained by playing on the keyboard of a traditional piano.

The mechanical system which is the object of the present invention is simple, cheap and dependable in operation, does not require any maintenance and finds application in a wide range of instruments.

Said device consists substantially of a lever, with a pivot in its lower part, a lever support which is integral with the structure of the keyboard, and an appendix, provided on the lower face of the key, said lever and said appendix being arranged such that, by pressing the key, said lever and said appendix come into contact with each other, at first by unobstructed movement and then sliding one onto the other, thus opposing by friction a certain amount of resistance to the descent of the key. The desired dynamic effect can be achieved according to two different solutions.

A first solution provides an adequately shaped, stiff appendix which is integral with and extends downwardly from the surface of each key of the keyboard, the appendix cooperating with a similarly shaped, opposing lever which is adapted to oscillate about its own pivot, the oscillation of said lever being controlled by a pressure spring and/or by an adjusting screw, while a second solution provides an appendix which is similarly integral with the key, but is resilient and is made of a wire spring or a ribbon spring which is suitably shaped in such a way to offer the impact resistance as well as

the desired friction effect in cooperation with a lever which is integral with an axis which is common to all the keyboard's levers and can be blocked rigidly in prefixed positions.

Said appendices and levers can be made of any material, for instance, a plastic material, capable of offering a certain friction and of withstanding wear, and may, even if not necessary, be lined with an antifriction and sound-dampening material, as for instance cashmere cloth or other type suitable for this purpose.

Said levers can be moved towards or moved away from the action line of the appendix, in order to either achieve, attenuate or eliminate the inertial dynamic and sliding effect.

According to the first embodiment of this invention, said operation is achieved by means of a small bar arranged longitudinally along the whole set of mechanisms, said bar being adapted to cause an angular displacement or rotation of the levers or a side sliding of the lever supports, out of the action line of the appendices (which are integral with the keys), whereas according to the second embodiment of this invention the levers may be inserted or disconnected by causing the common axis, with which said levers are integral, to rotate by a certain amount, and by blocking rigidly the axis itself at the desired position.

The positioning of the lever can be effected, for instance, by means of levers, push-buttons, knobs and the like, directly applied and/or by means of joints or other transmission means on the external side of the instrument.

Other features and advantages of the present invention will become apparent from the following detailed description thereof and from the accompanying drawings, wherein some preferred embodiments of the two different solutions of the invention are illustrated in an exemplary, non-limitative way.

IN THE DRAWINGS

FIG. 1 is a side elevational view partially in section of a key including a first embodiment of this invention wherein there is provided a stiff appendix and a yielding lever, the key being represented in its rest position;

FIG. 2 is another side elevational view, partially in section, illustrating the embodiment of FIG. 1, represented in the "lowered key" position;

FIG. 3 is a view similar the embodiment of FIG. 1, in the "lowered key" position, with the yielding lever moved away from the action line of the stiff appendix;

FIG. 4 shows, in partially sectioned side elevation, a modification of the embodiment of FIG. 1, wherein the lower end of the stiff appendix is provided with a sliding roller;

FIG. 5 shows, in partially sectioned side elevation a modification of the embodiment of FIG. 1, wherein the lower end of the yielding lever is provided with a sliding roller;

FIG. 6 shows, in partially sectioned side elevation a modification of the embodiment of FIG. 1, wherein provision is made to control the pressure exerted by the spring upon the yielding lever, in the rest position;

FIG. 7 shows, in partially sectioned side elevation the embodiment of FIG. 6 in the "lowered key" position, with the yielding lever moved away from the action line of the stiff appendix;

FIG. 8 is a partial sectional side elevational view of a key with its own device according to a second em-

bodiment, of the resilient appendix and stiff lever type, in the rest position;

FIG. 9 shows, partially sectioned and in side elevation, the embodiment of FIG. 8 in the "lowered key" position;

FIG. 10 shows, partially sectioned and in side elevation, the embodiment of FIG. 8 in the rest position, with the stiff lever moved away from the action line of the resilient appendix; and

FIG. 11 is a partially sectioned, side elevational view illustrating a simplified modification of the embodiment illustrated in FIG. 8.

Referring now to the drawings, the represented keyboard is of the type which is traditionally adapted for musical instruments of the reed, electric, electromagnetic, electronic type and the like, and comprises a plurality of natural note keys 1 and a plurality of sharp note keys 2, a keyboard support table 3, a support 4 of the fulcrum or pivot 5 of the key 1, a lining or bumper 6 of elastic and soft material applied to soften the return stroke of the key 1 and a helical return spring 7.

FIGS. 1 to 3 show, as it has been mentioned hereabove, a preferred embodiment of the mechanical system of the present invention, according to the first embodiment which provides a stiff appendix 8 and a yielding lever 11.

In these Figures, on the lower face of every key 1 or 2 of the keyboard there is provided an appendix 8 with its lining 9 cooperating with a friction or contact lever 10, which is suitably shaped, and which is pivoted on a pin 13, (where it has its own fulcrum) on a support 12 which is integral with the support or framework 3 of the keyboard. On said support 12 a micrometric adjustment screw 16 is provided, in order to allow the positioning of the lever 10, whereas, on the opposite side of the lever 10, a scissor spring 14 is anchored on the support 12, by means of a pin 15, said scissor spring 14 serving to keep and return the lever 10 to the rest position which is established by the screw 16.

When pressing the key 1 or the key 2, the appendix 8, which is lined and protected by means of an antifriction and sound-dampening material 9, initially effects with the corresponding lever 10 a stroke contact which converts then to a sliding contact. The lever 10, at least in the part which effects the contact with the appendix 8 of the key, is similarly lined with an antifriction and sound-dampening material 11.

Appendix 8 an lever 10 are so shaped that, when they contact initially each other, a feeling of escape and sliding can be obtained which is characteristic of the keyboards of traditional pianos.

This sensitive effect is provided by the friction resistance whose value is rendered variable by the particular shape which is imparted both to the appendix 8 and to the lever 10, as well as by the precise positioning of said lever 10 by means of the adjustment micrometric screw 16, by which the friction resistance can be increased or decreased, with a consequent variation of the desired effect.

In FIG. 3 the mechanism intended to achieve the inertial dynamic effect and the sliding effect, characteristic of a piano, is disconnected, and the keyboard works in the same way as the keyboards which up to date are generally adapted for the musical instruments of the reed, electric, electromagnetic, electronic type and the like. The disconnection and the connection of the mechanism can be effected by the player himself, in various ways, for instance by operating, through a controlling small key or lever (not represented) which is provided on the external side of the instrument, a small oscillating bar 18, arranged longitudinally along the whole set of the keyboard mechanisms, to cause a lateral displacement of the levers 10 out of the action line of the appendices 8, or vice versa.

It is obvious that, when the mechanism is disconnected, as it is shown in FIG. 3, by operating the key 1 or 2, the appendix 8 no longer meets with the corresponding lever 10.

The described embodiment can offer a variety of modifications, without a substantial modification of the idea of the mechanism or of its operating principles. For instance, the appendix 8 and/or the lever 10 may have a different shape from that which is represented in FIGS. 1 to 3, and said elements may be located at different positions, as it can be seen from FIGS. 4 to 7.

In FIG. 4, the appendix 8 of the key 1 terminates with a roller 9*a* which slides upon the upper portion of the lever 10, which is lined with an antifriction material 11.

In FIG. 5, the appendix 8 of the key 1 is unchanged, but a sliding roller 113 is provided on the upper end of lever 10.

In FIGS. 6 and 7, both the shapes of the appendix 8 and of the lever 10 are changed, and the lever 10 presents no longer an L-shaped configuration.

With this particular modification it has been possible to achieve the elimination of the adjustment screw 16 intended for the positioning of the lever 10, while provisions are made in order to allow the regulation of the pressure exerted by the lever 10 against the appendix 8.

In order to achieve this result, a metal tongue 17 is positioned under the support 12, between the support itself and the base 3: this tongue has, at its free terminal (16*a*-FIG. 6), which is projecting from the support 12, a notch 17*a* (FIG. 7) in which the end 14*a* of the scissor spring 14 is inserted while opposed to that, end 14*b*, of the spring 14 acts upon the lever 10. Said free end or terminal 16*a* of the metal tongue 17 is of a controllable height, this regulation being obtained through a variation of the bending angle (effected by hand or by the aid of a simple tool). The obtaining of a larger or lesser pressure of the spring 14 upon the lever 10 depends on the said regulation.

FIGS. 8 to 11 show other preferred embodiments of the mechanical system according to the second embodiment of the present invention, which provides the employment of a yielding element integral with the key, cooperating with a stiff element which is integral with the frame of the keyboard.

In the example represented to FIGS. 8 to 10, upon the lower face of every key an appendix 8*a* is applied which is provided with a spring 19 of a suitable shape. In correspondence with, and below said spring 19 a lever 20 is located, which may present for instance an elliptical, faceted or serrated section, protected, if necessary, by an antifriction lining 11. Said lever 20 is pivotable about an axis defined by a pin 13 which is common to all the keyboard's levers, and is capable of being blocked at prefixed positions.

The pin 13 is supported by the support 12 which is integral with the frame 3 of the keyboard, and can be rotated by a certain angle, for instance by means of a handwheel (not represented) which is integral with the

pin **13** itself, in order to move the end of the lever **20** toward or away from the action line of the springs **19**, and in order, therefore, to achieve, regulate or exclude the contact and the friction between the lever **20** and the corresponding spring **19**, when the key **1** or **2** is lowered.

According to the angular position in which the pin **13** is set, the following conditions will be obtained: a dynamic sensitive effect, an attenuation of this effect or the complete elimination of this effect.

Therefore, the same keyboard can be employed both as a keyboard having an inertial dynamic effect, and as a conventional keyboard of the type which is adapted for a musical instrument of the reed, electric, electromagnetic, electronic type and the like.

It is convenient to point out that, as far as the profile of the spring **19** is concerned, the contact taking place between said spring and the stiff lever **20** is a stroke contact at a first moment, and then is a sliding contact with variable friction.

FIG. **11** shows a simplified embodiment, wherein the spring **19** is not bent forwardly and is directly fixed upon the lower face of a key **1** or **2**.

From the above the mechanical system for keyboards of musical instruments of the reed, electric, electromagnetic, electronic type or the like is such as to satisfy the demands and requirements of every player, both in the case that they desire to feel to the touch of the fingers an inertial dynamic feeling and a sliding feeling similar to those produced by the machine of the traditional pianos, and in the case that they prefer to play keyboards of the type which is usually adapted for pianolas, organs, accordions or other musical instruments, both of a common and of an electronic type.

What is claimed is:

1. A mechanical system for piano-like musical instruments having a keyboard including a plurality of independently movable keys that are pivotably mounted on and resiliently biased with respect to a rigid support, said system comprising, in combination:

a. an appendix secured to and extending downwardly from the underside of each of the keys for movement together therewith upon the depression of a selected key;

b. a plurality of levers equal in number to said appendices and pivotly mounted on the rigid support, each said lever being associated with and normally positioned in opposition to one of said appendices whereby, when any key is depressed, said appendix secured thereto will first engage said associated lever with a stroke contact and then with a sliding contact to thereby simulate the "feel" of a conventional piano key; and

c. means for selectively displacing said levers from their normal position whereby, when any key is depressed, there will be no contact between said appendix secured thereto and said associated lever so that the "feel" of a conventional piano key will not be present.

2. The system according to claim **1** wherein said appendices include at least a partial surface covering of an anti-friction, sound dampening material.

3. The system according to claim **1** wherein said levers include at least a partial surface covering of an antifriction, sound dampening material.

4. The system according to claim **1** wherein there is further included means for adjusting the angular position of said levers.

5. The system according to claim **4** wherein said levers are substantially L-shaped and said adjusting means are screws threaded into the rigid support and arranged to bear against one of said legs of said levers.

6. The system according to claim **1** wherein there is further included a spring for urging each said lever towards the normal position thereof.

7. The system according to claim **6** wherein said spring is a bent leaf spring having one end thereof bearing against said lever and the other end thereof bearing against the support, the intermediate portion of said leaf spring being pivotly mounted relative to the support.

8. The system according to claim **6** wherein said spring is a bent leaf spring having one end thereof bearing against said lever and wherein there is further included a second spring for adjustably positioning the other leg of said bent leaf spring, the intermediate portion of said bent leaf spring being pivotly mounted relative to the support.

9. The system according to claim **1** wherein each said appendix includes a roller arranged to contact said associated lever.

10. The system according to claim **1** wherein each said lever includes a roller arranged to contact said associated appendix.

11. The system according to claim **1** wherein each said appendix comprises a spring arranged to contact said associated lever.

12. The system according to claim **1** wherein said displacing means comprises a longitudinally extending, externally movable bar having an axis that is substantially perpendicular to the planes of movement of said levers, said bar being laterally movable so as to deflect all of said levers from their normal position.

* * * * *