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Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
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(54) **Title:** AN APPARATUS AND METHOD FOR EMULATING THE TOUCH AND FEEL OF A REAL PIANO

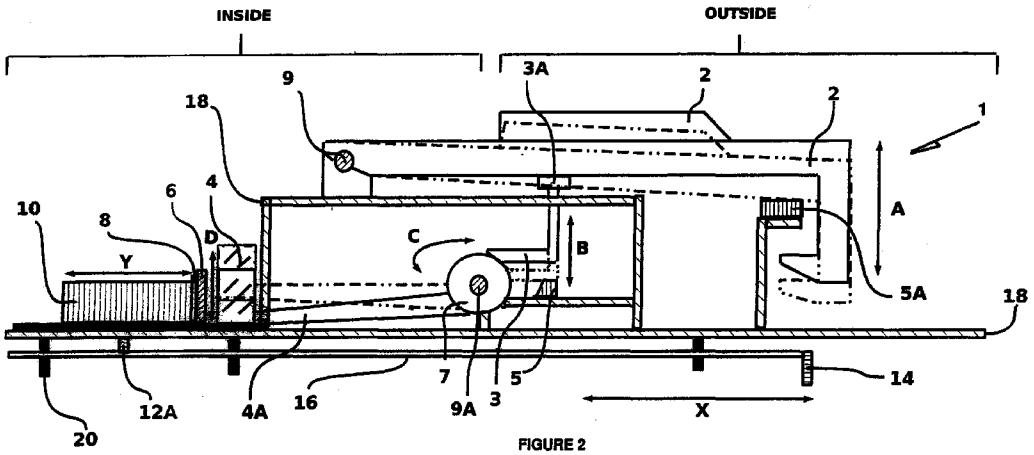

FIGURE 2

(57) **Abstract:** In the field of non-acoustic electric or non-electric pianos the feel of the aftertouch of keys is of importance to the end-user but appears lacking. A piano key mechanism(1) is movably attached about a first fulcrum(9) on a framework(18) attached to a piano, by adjusting movement(X) of bar(16) for moving(Y) block(1θ), actuating key(2) to active position(A), forcing downward movement(B) of plunger head(3A) and attached plunger(3) against counterweight unit(7) forcing a clockwise directional movement(C) for lifting arm(4A) and head(4) from a resting position to a raised position(D), applying magnetic resistance to head(4) and unit(7), releasing pressure on key(2) for moving unit(7) in a counter clockwise direction(C) returning head(4) and arm(4A) to a resting position(B) and key(2) back to a ready position(A).

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An Apparatus and Method for Emulating the Touch and Feel of a Real Piano

The present invention relates generally to an apparatus and method for emulating the touch and feel of a real piano. In particular, the pressure sensitivity of the piano key is adjustable to provide the effect of a jack pushing a knuckle of an acoustic piano to provide an "aftertouch" of the key.

BACKGROUND OF THE INVENTION

The touch and feel of a real piano emanates from the unique construction of a piano. An acoustic piano mechanism transfers the motion of a key to a hammer impacting upon the respective string or strings via a jack pushing a knuckle within the mechanism. When in use, the mechanism represents a considerably sophisticated design that should comply with a number of requirements, involving the task to make the performance pleasant, agreeable, and definite.

An "electric piano" has an electro-mechanical mechanism analogous to that of an electric guitar. An "electronic piano" also referred to as an electronic keyboard has no weighted action or velocity sensitivity having the sound generated through synthesizers. In comparison, a "digital piano" has a weighted key action in an attempt to imitate the action of an acoustic piano and uses digitally sampled sounds, amplifiers and speakers instead of strings and hammers to produce the sound of an acoustic piano.

Pressure sensitivity or aftertouch is the act of lifting the key after it has been played. The purpose of the piano action is to translate every touch of the player's finger and hand movements into a musical note that reflects the exact intentions of the player. The slightest change in the speed of the stroke, the firmness of the stroke and even the release of the key are features associated with the type of pianist playing on a chosen keyboard of the piano. Accordingly, the pianist can feel the varied resistances from the key actions when playing either a small or large grand piano or an upright piano. Existing electronic keyboards apply aftertouch controls by using piezoelectric elements contacted by the key, however, uniform and predictable aftertouch control is particularly difficult to achieve when relying on compressible strips or piezoelectric elements as their electrical characteristics may vary use over a prolonged period of time.

In light of the above limitations of non-acoustic pianos, there is a need for a piano with the an adaptable key stroke resistance feature to provide the aftertouch feel of piano keys normally associated with large or small grand pianos or upright pianos and a need to provide a method of adjusting that aftertouch feature to provide that unique feel of playing either small or large grand pianos or upright pianos.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an apparatus and method for emulating the "aftertouch" of a key on a non-acoustic piano. In particular, the pressure sensitivity of the piano key mechanism is adjustable to provide the same effect of a jack pushing a knuckle within an acoustic piano thereby providing the effect of the aftertouch.

An aspect of the invention provides an apparatus for adjusting a piano key aftertouch comprising a piano key mechanism of a piano keyboard having at least one piano key movably attached about a first fulcrum on a framework attached to a piano, wherein the key engages a plunger and a counterweight unit movably attached to frame allowing for movement about a second fulcrum and for movement about a magnet, the unit having an arm and a head extending therefrom, whereby the magnet is adjustable in a direction about the head for effecting the piano key aftertouch.

Another aspect of the invention provides a method for effecting a piano key aftertouch whereby adjusting movement of bar for moving block to a chosen position of magnetic resistance, actuating key from a resting position to an active position, triggering a downward movement of plunger head and attached plunger against counterweight unit forcing a clockwise directional movement for lifting arm and head from a resting position to a raised position, applying magnetic resistance to head and unit, releasing pressure on key for moving unit in a counter clockwise direction returning head and arm to a resting position and key to a ready position.

A preferred embodiment of the invention provides for the magnet to be mounted on a block for moving in a horizontal direction about a block track in relation to the head of the unit, the block being releasably secured on to a frame by at least one securing member attached to a bar, the magnet or head is moved by

physical means, mechanical means, electrical means or a combination thereof for effecting a non-contact area between the magnet and head. Optionally, the head of unit is magnetized and a metal support strip of block is magnetically responsive thereto.

In a preferred embodiment of the invention the mechanism can be used in acoustic and non-acoustic instruments using electrical means, mechanical means, physical means or combinations thereof.

An embodiment of the present invention provides for movement of key to be equal or not in distance to a the movement of plunger.

In another aspect the present invention provides at least one body releasably attached to a magnet for movement to and from a non-contact area thereof, the body defining means to move to and from one position to a further position to effect aftertouch, the at least one body movably attached to the body of the piano.

Another aspect of the invention provides an apparatus for adjusting a piano key action having at least one piano key mounted on a fulcrum of a piano, the key having a distal end and a proximate end, the distal end having adjacent thereto a counter weight, the proximate end used for actuating the counter weight, an adjustable magnet movable about counter weight, the magnet and counter weight used for applying aftertouch on piano key when actuated by the end user.

In a further aspect the present invention provides at least one piano keyboard having a series of piano keys each key being pivotally attached to a body of the piano, the key having a body length with a proximal end and a distal end separated by a fulcrum, the proximal end defining a playing surface, the distal end defining a counter weight thereon, an adjustable magnet positioned adjacent a metal of the counter weight for inducing a required magnetism on the distal end and proximal end of the key body thereby increasing or decreasing an aftertouch chosen by the end user.

A further aspect of the present invention there is provided an apparatus for adjusting a piano key action comprising: at least one piano key mounted on a fulcrum, the key having a distal end and a proximate end, the distal end having attached thereto a counter weight, the proximate end open to the end user for

actuating the counter weight, an adjustable magnet movable about the non-contact area and adjacent the counter weight, the magnet and counter weight applying resistance on a key of the piano key when actuated by the end user.

In another aspect of the present invention there is provided a method for emulating the touch and feel of a real piano comprising the steps of adjusting a pressure sensitivity key mechanism of a keyboard system and effecting an aftertouch of the piano key upon release of the key.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of part of a piano keyboard thereof showing the outside and inside of the piano keyboard defining an aspect of the present invention.

FIG. 2 is a side cross-sectional view of a key of the present invention showing the movement of the key in relation to an aspect of the present invention.

FIG.3 is a enhanced cross-sectional view of the preferred aspect of Figure 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG.1 a piano keyboard **1** having at least one key **2** extending from the **outside** to the **inside** as indicated.

Area **B** is a designated area for the end user, whereas area **A1** is an area designated for electrical or mechanical components applicable to the piano and keyboard therefore. The piano key **2** extends through to the mechanical and electrical area **A1** and accordingly defines a proximate and distal section of the key **2**, the distal section showing a counter weight head **4** extending from an arm **4A** as shown in Figure 2. The head **4** can be a metallic material or a magnetic material, preferably a metallic material is used. The head **4** is positioned adjacent a support strip **8** supporting a magnet **6**, the support strip **8** can as an alternative be made from a metal that is responsive to a magnetic field and the head **4** be a magnet **6** responsive thereto. The character **Y** indicates selected movement of an adjustable block **10** which is movable about a block track **12** and secured in to a chosen position by a securing member **12A**. The

movement of the block **10** moves the metal or magnet attached thereto to effect an aftertouch of the key **2** in relation to an end users actuation. Accordingly, a non-contact area exists between the magnet **6** and the cooperating metal of the head **4**. The distance in-between the non-contact area (shown in figures 2 and 3) of the magnet **6** and head **4** can be effected by other means other than the one provided, which can include motorized horizontal or vertical movement thereof as controlled or actuated by the end user to effect aftertouch.

Figures 2 and 3, further provide the mechanism of the present invention. In particular, **1** designates a piano mechanism supported upon a framework **18** covering the length of the **outside** and **inside** portion of the keyboard. The character **A** designates the downward movement(dotted lines) of a proximal end of key **2** on the **outside** portion of the piano. The key **2** is pivoted on a fulcrum **9** at a distal end thereof allowing for the downward movement which in turn depresses plunger head **3A** forcing downward plunger **3** to a position upon first stopper **5**, second stopper **5A** engages an underside of key **2**, plunger **3** attached to a counterweight unit **7** having a head **4** and arm **4A** for movement **B**(dotted lines) of plunger **3** in a downward clockwise motion **C** about a fulcrum **9A** attached to frame **18**, in turn head **4** is moved in an upward direction **D**(dotted lines) allowing to effect the magnetized movement of the head **4**. Return of the unit **7** to a resting position is reliant upon the end user taking pressure off the key **2** and involves counterweight head **4** of unit **7** forcing down the arm **4A** which in turn rotates about the fulcrum in an anti-clockwise direction resting the key **2** in an upright position. The aftertouch effect is preferably produced upon release of the key **2** after a third of the distance of the downward stroke of the key **2** has been depressed, thereby giving the feel of a jack of a normal piano mechanism pushing on a knuckle thereof. To regulate the effect of the aftertouch the end-user has the means to control movement of the block **10** about block track **12** by adjusting a first securing member **12A** about block **10** in a fixed position. Movement **Y** of block **10** is actuated by the end-user(not shown) in which grip member **14** is engaged in a forward or backward movement X of bar 16 movable about a second securing member 20 dependent upon the choice or level of aftertouch effect required. The mechanism**1** can be used in acoustic and non-acoustic instruments using electrical means, mechanical means, physical means or combinations thereof.

I CLAIM:

1. An apparatus for adjusting a piano key aftertouch comprising a piano key mechanism(1) of a piano keyboard having at least one piano key(2) movably attached about a first fulcrum(9) on a framework(18) attached to a piano, characterized in that the key(2) engages a plunger(3) and a counterweight unit(7) movably attached to frame(18) allowing for movement about a second fulcrum(9A) and for movement about a magnet(6), the unit(7) having an arm(4A) and a head(4) extending therefrom, whereby the magnet(6) is adjustable in a direction about the head(4) for effecting the piano key(2) aftertouch.

2. The apparatus of claim 1, further characterized in that the magnet(6) is mounted on a block(10) for moving in a horizontal direction(Y) in relation to head(7) about a block track(12) releasably secured on frame(18) by at least one securing member(12A) attached to a bar(16).

3. The apparatus of claims 1 or 2, characterized in that the magnet(6) or head(4) is moved by physical means, mechanical means, electrical means or a combination thereof for effecting a non-contact area between the magnet(6) and head(4).

4. The apparatus of claims 1 to 3, characterized in that the unit(7) is moved by physical means, mechanical means, electrical means or a combination thereof for effecting a non-contact area between the magnet(6) and head(4).

5. The apparatus of claim 1, characterized in that the head(4) of unit(7) is magnetized and a metal support strip(8) of block(10) is responsive thereto.

6. The apparatus of claim 1, characterized in that a vertical movement(A) of key(2) is equal in distance to a vertical movement(B) of plunger(3).

7. The apparatus of claim 1, characterized in that the vertical movement(A) of key(2) is not equal in distance to the vertical movement(B) of plunger(3).

8. The apparatus of any one of claims 1 to 7, characterized in that the mechanism(1) can be used in acoustic and non-acoustic instruments.

9. The apparatus of claim 8, characterized in that the instruments can be electrical, mechanical, or combinations thereof.

10. A method for effecting a piano key aftertouch characterized in that adjusting movement(X) of bar(16) for moving(Y) block(10) to a chosen position of magnetic resistance, actuating key(2) from a resting position to an active position(A), triggering a downward movement(B) of plunger head(3A) and attached plunger(3) against counterweight unit(7) forcing a clockwise directional movement(C) for lifting arm(4A) and head(4) from a resting position to a raised position(D), applying magnetic resistance to head(4) and unit(7), releasing pressure on key(2) for moving unit(7) in a counter clockwise direction(C) returning head(4) and arm(4A) to a resting position(B) and key(2) to a ready position(A).

11. The method of claim 10, characterized in that the the magnet(6) is mounted on a block(10) for moving in a horizontal direction(Y) in relation to head(7) about a block track(12) releasably secured on frame(18) by at least one securing member(12A) attached to a bar(16).

12. The method of claims 10 or 11, characterized in that the magnet(6) or head(4) is moved by physical means, mechanical means, electrical means or a combination thereof for effecting a non-contact area between the magnet(6) and head(4).

13. The method of claims 10 to 12, characterized in that the unit(7) is moved by physical means, mechanical means, electrical means or a combination thereof for effecting a non-contact area between the magnet(6) and head(4).

14. The method of claim 10, characterized in that the head(4) of unit(7) is magnetized and a metal support strip(8) of block(10) is responsive thereto.

15. The method of claim 10, characterized in that a movement(A) of key(2) is equal in distance to a movement(B) of plunger(3).

16. The method of claim 10, characterized in that the movement(A) of key(2) is not equal in distance to the movement(B) of plunger(3).

17. The method of any one of claims 10 to 16, characterized in that the mechanism(1) can be used in acoustic and non-acoustic instruments.

18. The method of any one of claims 10 to 16, characterized in that the instruments can be electrical, mechanical, or combinations thereof.

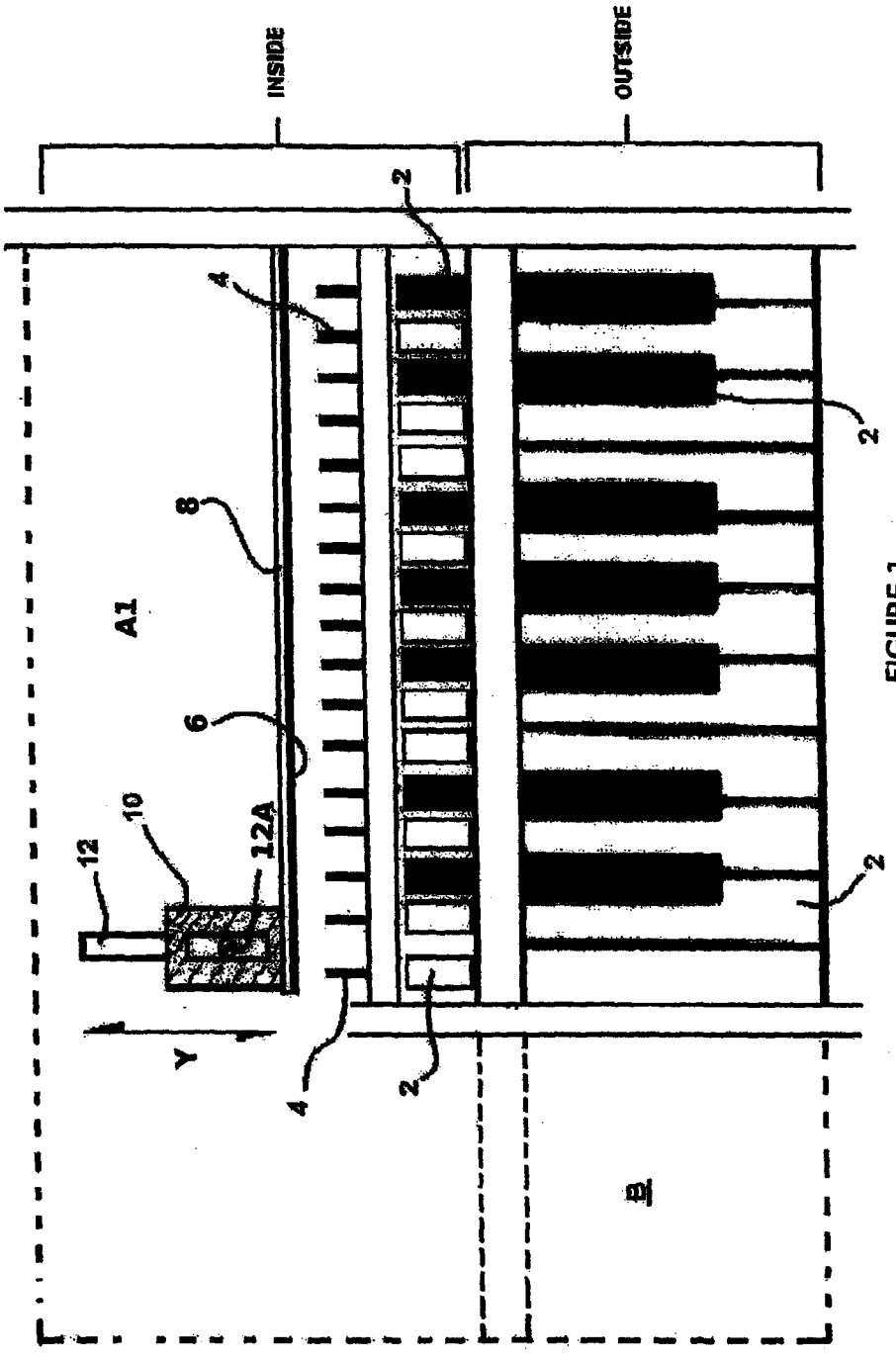

FIGURE 1

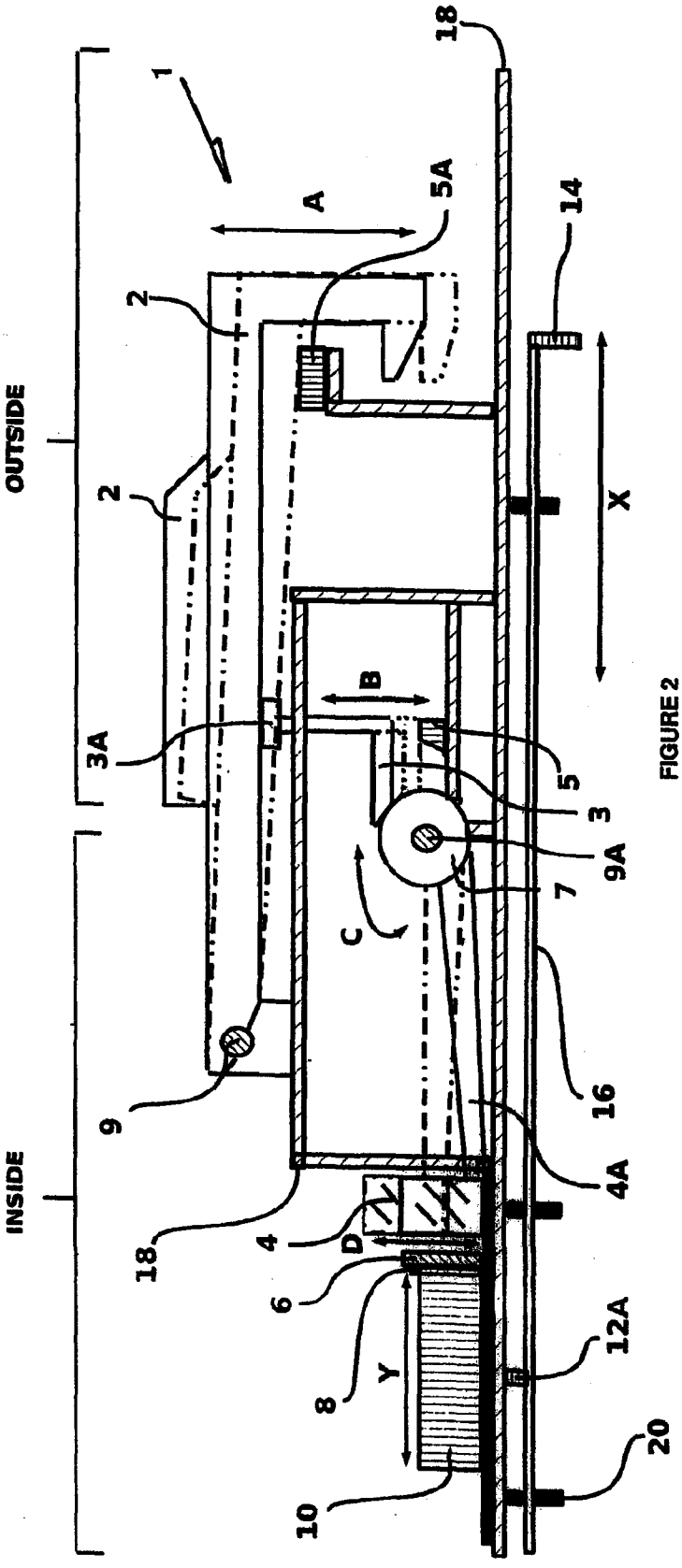

FIGURE 2

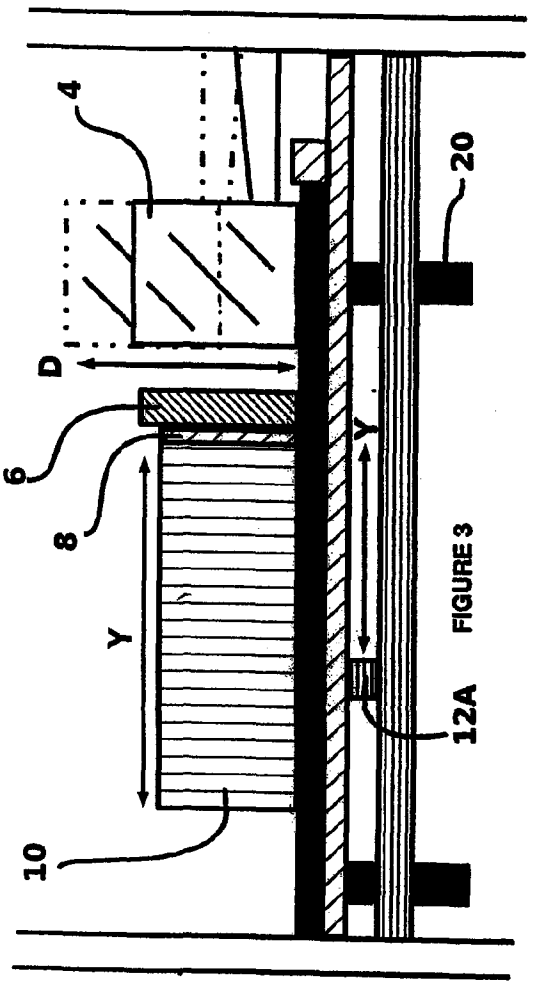

FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2008/001791

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***G10C 3/12*** (2006.01) , ***G10H 1/34*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: G10C (2006.01), G10H (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Delphion, US Patent Office Database (WEST), Canadian Patent Office Database (Intellect). Keywords: (piano, key, fulcrum, plunger, frame, arm, magnet, head)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,062,342 (Nagatsuma), 05 November 1991 (05-11-1991) *See whole document	1 to 18
A	US 7,186,907 (Inouye), 06 March 2007 (06-03-2007) *See whole document	1 to 18
A	US 4,338,848 (Brennan), 13 July 1982 (13-07-1982) *See whole document	1 to 18
A	US 7,279,627 (Tanaka), 09 October 2007 (09-10-2007) *See whole document	1 to 18
A	US 4,381,691 (Conklin, Jr. et al.), 03 May 1983 (03-05-1983) *See whole document	1 to 18

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Mazen Hijazi 819- 953-5765

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2008/001791

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