

1

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ACTION FOR KEYBOARD INSTRUMENTS

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ABSTRACT OF THE DISCLOSURE

A keyboard instrument comprising a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each jumper being a two-armed lever including an upper and a lower arm. The upper arm carries a corresponding plectrum at its upper end thereof. Each of the jumpers is shiftable pivotally about the upwardly movable horizontal axis between an upper and a lower position. A plurality of control members are provided and means through which each control member when actuated, raises the horizontal axis as well as pivoting the lower arm of a corresponding jumper into its upper position along an upward pivotal path of the upper arm of the corresponding jumper engaging a corresponding sound generator and upon release of the control member allows the jumper to first pivotally move along a downward pivotal path extending away from the sound generator freely returning into its lower position.

This invention relates to improvements in keyboard instruments, in general, and to keyboard instruments with sound generators energized upon striking by a plectrum and producing an action for keyboard instruments of such a type in particular.

It is an object of the present invention to provide an improved action for keyboard instruments comprising a jumper constituted by a substantially vertical two-arm lever of which the upper arm carries a plectrum which lies in its inoperative condition underneath a sound generator and which is adapted to rock during its up and down movement in a manner such that the path followed by the plectrum during the upward movement extends through the area occupied by the sound generator while, during its return movement, it is rocked outside the area occupied by the sound generator and is caught at its lower end forming a countercatch.

Since the plectrum, when it returns, no longer touches the generator, there is eliminated any objectionable influence on the fading away of the sound. This is of a decisive importance, in particular for musical instruments wherein the sound generators are started in any manner whatsoever and the mechanical oscillations are transformed electronically into acoustical oscillations. Also, the action responds to the different manners of attacking the notes.

With the above and other objects in view, which will become apparent in the following detailed description in conjunction with the accompanying drawing, the present invention will be more clearly understood, in which:

FIGURE 1 is a fragmentary sectional side elevation of the action and

FIGURE 2 is an enlarged fragmentary plan view of an embodiment of a plectrum.

Referring now to the drawing, an action beam 1 carries a so-called jumper 2, that is the member which carries a plectrum 6 and which guides the plectrum. The jumper in my improved action is constituted by a two-armed

2

lever, with arms 2a and 2b. The jumper 2 is carried pivotally approximately through its middle point by a substantially horizontal carrier 3, the latter being secured pivotally to the action beam 1 through a fork 4.

The carrier 3 is constituted, in the example illustrated, by a forked lever engaging laterally through its tines the jumper 2. It is apparent that the jumper 2 upon rocking of the forked carrier 3 may move upwardly and downwardly and furthermore it may execute a rocking movement round its horizontal axis connecting it with the forked carrier 3. It should be noted that a simpler embodiment is possible by cutting out the upwardly and downwardly rocking carrier 3, so as to allow the upward and downward movements of the jumper, inside which an elongated slot is formed for this purpose through which slot a stationary spindle extends in such a case.

The upper arm 2a of the jumper carries a supporting rod 5 carrying in its turn the plectrum 6. The supporting rod 5 which is advantageously provided with a thread is rotatably carried in a recess or bore formed in the lever arm of the jumper 2 and it can be rigidly secured thus in the desired position. As illustrated in FIG. 2, the plectrum is circular and fitted eccentrically on the carrier rod 5.

The position in which the action is illustrated is its inoperative position for which the jumper is held by elastic means, as provided merely by a single compression spring 9. The vertically directed component of the force of the spring acts accordingly to urge downwardly the jumper into its lower terminal position as illustrated, which is defined by a support 19 extending underneath the carrier member 3, while the horizontal component of the force urges the lower lever arm 2b towards the right-hand side against an adjustable stationary stop or abutment formed by screw 10 against which the arm 26 rests.

The key or the like raising member 11 is provided with an adjustable abutment member or catch 12, the countercatch or counter abutment member being constituted by the lower end 13 of the lever arm 2b. The rear end of the key 11 is mounted on a rocking lever 20 subjected to the action of a spring. The lever 20 is provided with a recess 20' in which a thrust rod 15 is engaged, which thrust rod carries at its upper end a damping member 16. The latter rests on sound generator 17 for the inoperative illustrated position of the action. The damping member 16 is vertically adjustable. When the raising member or key is depressed, the thrust rod or plunger 15 is also shifted upwardly during the upward movement of the jumper 2 with a slight delay, so that the damping member 16 releases then the sound generator 17. The latter can thus, after energization, oscillate freely until the thrust rod 15 returns into its lowermost position as illustrated after release of the key 11, whereby the damping member or cushion 16 falls on the sound generator 17 and dampens the oscillations thereof. There is also provided a control bar 18 which can raise simultaneously all the damping members through a counter-clockwise movement, which bar may be actuated through a pedal or through a bell crank (not illustrated).

When, in contradistinction, another control bar 20a is shifted towards the right-hand side, all the thrust rods 15 are shifted to the right-hand side into the recesses 20' so that the left edge of the recess 20' of the rocking lever 20 can no longer act on the thrust rods 15. Accordingly, the damping members 16 remain in their lower positions resting on the sound generators 17.

The jumper illustrated operates accordingly in a manner such that, upon depression of the key 11, it is raised and the plectrum 6 strikes and energizes the sound generator 17 to start oscillations thereof. Inwardly curved recess 8 then urges the lower lever arm 2b laterally to the left-hand side since the lower oblique sur-

face defining the recess 8 now engages the rounded end of the adjustable abutment screw 10. Through this pivotal movement of the jumper in a clockwise direction, the counter-catch 13 is released and slides along the left-hand end of the catch 12 of the jumper and falls until it reaches the illustrated lowermost position which is defined by the carrier member 3 on the support 19. It is apparent that with such a downward movement, the plectrum is free and is guided at a distance from the position of the tip of the sound generator 17. When the key 11 is released and returns correspondingly into its inoperative position the spring 9 acts in a manner such that the jumper 2 returns through a counterclockwise rocking into its inoperative starting position, which means that the tip of the counter-catch 13 again engages the upper end of the catch 12. Thus, the sound production cycle comes to an end.

With this action, the path through which the jumper 2 moves upwardly or the so-called rising height, is defined through adjustment of the adjusting screw 10a defining the lowermost position of the carrier member 3. The screw 10a permits therefore the adjusting of the raising height to any desired value. The release of the jumper after the sound has been produced, that is its re-engagement with the catch, as to position and time, is adjusted by the abutment screw 10.

In order to accurately produce a desired sound, it is essential that the tones of different notes coincide as to intensity, and consequently so that the different notes may not be produced markedly louder than the others. This uniformity of production of sounds and also other acoustical properties depend on the manner in which the sound generators, the sizes of which are quite different within the complete range of sounds, are energized. Consequently, it is possible to adjust selectively the degree of engagement with the sound generator and this is obtained by adjusting vertically the rod 5 carrying the plectrum, whereby the distance between the plectrum 6 and the sound generator 17 is modified. Since the plectrum, as illustrated in FIG. 2 is eccentrically secured to the supporting rod 5, it is possible, through a rotation of the rod, to modify also the depth of engagement. In the position illustrated in FIG. 2, the plectrum 6 projects only to a reduced extent underneath the sound generator which is constituted, in the example illustrated, as a reed 17, so that the reed, when actuated, vibrates with a reduced amplitude. If the plectrum is however shifted, for example, by 180°, that is to its other extreme position, it projects substantially further beyond the end of the reed 17. By reason of such increased depth of engagement, the plectrum when subjected to an upwardly directed thrust urges the tip of the reed 17 upwardly with a greater force to make the latter execute more powerful oscillations. Within the range extending between these two extreme terminal positions continuous degrees of adjustment of the plectrum is possible, the depth of engagement being able to be adjusted as desired.

By rotating the rod 5 carrying the plectrum, it is possible to provide both adjusting movements, to wit: the modification of the distance between the plectrum and the sound generator and the depth of engagement of the plectrum with the sound generator.

The action illustrated and described hereinabove is an example permitting an understanding of the structural features constituting the present invention. Of course, other structural embodiments in accordance with the present invention can be provided. In all cases, many other applications are possible within the scope of musical instruments provided with mechanically oscillating sound generators energized through striking, for instance, those provided with strings or laterally fitted rods, freely oscillating reeds and the like. The action according to my invention, is of particular interest in those instruments where the oscillations of the mechanically energized sound generators are not transmitted directly, but are

formed as mechanical oscillations which are transformed electronically into acoustical vibrations. In the case of musical instruments of such a type, my improved action allows a substantial improvement in the playing and in the sound and in particular it cuts out all parasitic noises which appear in prior instruments when the plectrum returns into its starting position through contact with the mechanical sound producer.

I claim:

1. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, and means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and moves said corresponding jumper into its upper position along an upward path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending away from said corresponding sound generator.
2. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and moves said corresponding jumper into its upper position along an upward path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said upper arm of said corresponding jumper to pivotally move oppositely away from said corresponding sound generator, and means urging said jumper to freely return into its lower position along a path extending away from said sound generator.
3. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position and being provided with a lateral cam-shaped recess, an adjustable stop adapted to enter said recess when said jumper is near its lower position, a plurality of control members, means releasably engaging the lower end of said jumper through which each control member when actuated

5

raises the lower arm of a corresponding jumper and its corresponding horizontal axis into its upper position,

means acting on said corresponding jumper to make said cam-shaped recess therein engage slidably said adjustable stop during the upward movement of said jumper for pivoting said jumper,

said cam-shaped recess curved so as to cause said lower arm of said corresponding jumper to move when said corresponding plectrum is raised so that said upper arm and said corresponding plectrum moves toward and strikes a corresponding sound generator and so that after said striking, said lower arm is pivoted off said means releasably engaging the lower end of said jumper and causing simultaneously said plectrum to pivot away from said corresponding sound generator,

said means for acting on said corresponding jumper further for causing said lower arm to return to its lower position slidably abutting one end of said means releasably engaging the lower end, when said lower arm is pivoted off, and

said means releasably engaging the lower end and said one end of said means releasably engaging the lower end positioned relative said lower arm during said slidably abutting return of said jumper to its lower position such that said cam-shaped recess is out of engagement with said adjustable stop, thereby causing said jumper and corresponding plectrum to freely return into its lower position along a path extending away from said corresponding sound generator.

4. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of keys, an abutment means carried by each key releasably engaging the lower end of a corresponding jumper for raising said jumper and said horizontal axis when each of said keys is actuated, and means for rotating said lower arm of said jumper simultaneously with the raising of said jumper into its upper position along a pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allowing thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of the said corresponding sound generator.

5. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, a one arm lever pivotally interconnecting each control member with a corresponding jumper and through which the latter and its corresponding horizontal axis is raised by said control member, and means for rotating said lower arm of said jumper simultaneously with the raising of said jumper into

6

its upper position along a pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allowing thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator.

6. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm of which the upper arm carries a corresponding plectrum at its upper end, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, a one arm lever pivotally interconnecting each control member with a corresponding jumper and through the latter and its corresponding horizontal axis is raised by said control member, means for rotating said lower arm of said jumper simultaneously with the raising of said jumper into its upper position along a pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allowing thereafter said upper arm of said corresponding jumper to pivotally move away from said corresponding sound generator, means urging said jumper to freely return into its lower position along a path extending away from said sound generator, and an adjustable stop system operatively cooperating with said one arm lever to define said lower position of said jumper.

7. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each generator, respectively, a plurality of jumpers adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, means securing a corresponding plectrum on said upper arm at a vertically adjustable position, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, and means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said sound generator and allows thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator.

8. A keyboard instrument, comprising in combination a plurality of sound generators, a plurality of plectrums each adapted to strike each sound generator, respectively, a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, a vertical supporting rod adjustably screwed into the upper end of the upper arm and carrying a plectrum, each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position, a plurality of control members, and means through which each control member when

actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator.

9. A keyboard instrument, comprising in combination a plurality of sound generators,
a plurality of circular plectrums each adapted to strike each sound generator, respectively,

a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm,

a vertical supporting rod adjustably fitted in the upper end of the upper arm and eccentrically carrying a plectrum,

each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position,

a plurality of control members, and

means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator.

10. A keyboard instrument, comprising in combination a plurality of sound generators,

a plurality of plectrums each adapted to strike each sound generator, respectively,

a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, of which the upper arm carries a corresponding plectrum at its upper end,

each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position,

a plurality of control members,

means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator,

a damping member cooperating with each sound generator and normally resting thereon,

a thrust rod actuated by a corresponding control member independently of said corresponding jumper to raise said corresponding damping member off said sound generator upon operation of said corresponding control member, and

said damping member returning onto said sound generator upon release of said corresponding control member.

11. A keyboard instrument, comprising in combination

a plurality of sound generators,

a plurality of plectrums each adapted to strike each sound generator, respectively,

a plurality of jumpers each adapted to pivot around

an upwardly movable horizontal axis and each including an upper and a lower arm, of which the upper arm carries a corresponding plectrum at its upper end,

each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis, between an upper and a lower position,

a plurality of control members,

means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said corresponding jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator,
a damping member cooperating with each sound generator and normally resting thereon,

a thrust rod actuated by a corresponding control member independently of said corresponding jumper to raise said corresponding damping member off said sound generator upon operation of said corresponding control member,

said damping member returning upon said sound generator upon release of said corresponding control member, and

common control means for simultaneously raising all of said damping members together independently of said control members, thereby to release said sound generators.

12. A keyboard instrument, comprising in combination

a plurality of sound generators,

a plurality of plectrums each adapted to strike each sound generator, respectively,

a plurality of jumpers each adapted to pivot around an upwardly movable horizontal axis and each including an upper and a lower arm, of which the upper arm carries a corresponding plectrum at its upper end,

each of said jumpers being shiftable pivotally about said upwardly movable horizontal axis between an upper and a lower position,

a plurality of control members,

means through which each control member when actuated raises the lower arm of a corresponding jumper and its corresponding horizontal axis and pivots said corresponding jumper into its upper position along an upward and pivotal path causing said corresponding plectrum to strike a corresponding sound generator and allows thereafter said jumper to pivotally move away from said corresponding sound generator and to freely return into its lower position along a path extending outwardly of said corresponding sound generator,

a damping member cooperating with each sound generator and normally resting thereon,

a thrust rod actuated by a corresponding control member independently of said corresponding jumper to raise said corresponding damping member off said sound generator upon operation of said corresponding control member,

said damping member returning upon said sound generator upon release of said corresponding control member, and

a common control means adapted to control simultaneously all of said thrust rods to operatively disconnect them from actuation by said control member and thereby allow said damping members to remain lying on said corresponding sound generators.

9

10

13. A keyboard instrument comprising
 a sound generator,
 a jumper comprising a two-armed lever pivotally
 mounted about a movable axis,
 a plectrum connected to one arm of said jumper adja- 5
 cent said sound generator,
 lever means including a surface abutting said other
 arm for moving said jumper and said movable axis
 therewith along a first path toward said sound gen- 10
 erator so that said plectrum strikes said sound
 generator,
 means for pivoting said jumper about said movable
 axis immediately after said lever means causes said
 plectrum to strike said sound generator and in a 15
 pivoting direction so that said plectrum moves
 away from said sound generator and such that said
 pivoting direction causes said other arm of said
 jumper to move relative to said surface of said lever
 arm and causing said jumper to return to its inop- 20
 erative position along a second path away from said
 sound generator different from said first path and
 independent of the return movement of said lever
 means.
14. The keyboard instrument, as set forth in claim 13,
 wherein said means for pivoting comprises 25
 a cam surface operatively cooperating with said jumper
 during its movement by said lever means,
 means for urging said jumper to return to its inopera-
 tive position along said second path and for urging 30
 said other arm of said jumper against an end of
 said lever means guiding said jumper along said
 second path and out of operative cooperation with
 said cam surface, and
 said latter means further for positioning said other arm 35
 of said jumper on said surface of said lever means
 when said jumper and lever means independently
 are returned to their inoperative position.
15. The keyboard instrument, as set forth in claim 13,
 further comprising 40
 a movable damping member means for resting on said
 sound generator,

- rocking lever means operatively connected with said
 lever means and releasably operatively connected
 with said damping member means for removing the
 latter from said sound generator when said lever
 means is actuated, and
 a control bar means for releasing said damping member
 means from operative connection with said rocking
 lever means so that said damping member means
 always rests on said sound generator.
16. The keyboard instrument, as set forth in claim 13,
 further comprising
 a movable damping member means for resting on said
 sound generator,
 rocking lever means operatively connected with said
 lever means and releasably operatively connected
 with said damping member means for removing the
 latter from said sound generator when said lever
 means is actuated, and
 a control bar means for releasing said damping mem-
 ber means from operative connection with said rock-
 ing lever means and for removing said damping
 member means from said sound generator independ-
 ently of actuation of said lever means.

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