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PIANO DAMPENING MECHANISM

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11 Claims. (Cl. 84-404)

1

The present invention relates to pianos and, primarily, to pianos of miniature size. The invention is a modification of and improvement upon the type of piano construction shown in my co-pending application for patent, Serial No. 726,004, and reference is made to that application for a full and complete disclosure of certain features of the invention and of the type of musical instrument with which the present improvements may be employed.

The invention, however, is not confined in its use to pianos of this type, since the piano action and vibration dampening means described below may be used to great advantage with conventional, full-size pianos.

The primary object of the invention is to provide improved and simplified vibration controlling and dampening devices, to the end that the action will be substantially the same as the action in full size, conventional pianos.

Another object is to provide an improved piano action and dampening mechanism for use in conventional pianos having conventional piano harps and sounding boards.

The invention provides an exceedingly simple dampening action, in which the dampening devices are moved to an inoperative position when the corresponding keys are struck, and are held in that position as long as the keys are depressed, but which are immediately brought into vibration dampening position when the keys are released. Hence, the tone duration of individual notes may be controlled, within the usual limits, by the length of time that the individual keys are held down, as in the case with large, expensive, conventional pianos.

Another object of the invention is to provide an improved sustaining action control, similar to the sustaining pedal of standard pianos. To this end, the invention provides simple, inexpensive, and efficient means for rendering all of the vibration dampening devices inoperative simultaneously, so that the vibrations of all keys struck will continue until they normally die down or until the dampening devices are again simultaneously brought into operation, by manual or pedal control.

Another object of the invention is to provide an improved hammer supporting structure, which is simpler, cheaper and better suited for the desired purposes than corresponding structures heretofore known.

Other and further objects and advantages of the invention will be apparent from a consideration of the following description of a preferred em-

2

bodiment, shown by way of example, in the accompanying drawings, in which,

Figure 1 is a longitudinal sectional view of the piano;

Figure 2 is a fragmentary plan, taken substantially on line 2-2 of Figure 1;

Figure 3 is a similar view on line 3-3 of Figure 1;

Figure 4 is a detail section and elevation, on an enlarged scale, taken on line 4-4 of Figure 1, and

Figure 5 is a fragmentary perspective view of an improved hammer supporting comb.

The piano comprises a unitary, molded, plastic, resonant case 10 of fiber glass or the like, which serves as the piano sounding board, as explained in my application identified above. The case 10 has a top wall 11, front and rear walls 12 and 13, and integral side walls, one of which is shown at 14, all connected by rounded corners and secured to a base casting 15. The base has side flanges 16 and a front section 17, to which the forwardly extending, open, shelf-like portion 18 of the case is secured. A finishing and strengthening strip 19 may extend along the lower edge of the front wall 12, adjacent the keyboard.

The base 15 includes a transversely extending fulcrumed rail 20 for the white keys 21, and the black keys 22 which project forwardly and rearwardly from the rail. Projecting upwardly from the rail are two series of pins 23, 24, extending through apertures 25 in the bottoms of the keys and disposed snugly within longitudinal guiding slots 26. Felt strips 27 and 28, disposed between the rail 20 and the undersurfaces of the keys, surround the pins 23 and 24 and serve as cushion fulcrums for the keys. At their forward ends the keys are provided with guide slots 30, embracing two series of upwardly projecting pins 31 and 32, carried by the front section 17 of the base. It will be understood that the more rearwardly positioned pins 32 and 24 are associated with the black keys 22, while the forwardly positioned pins 31 and 25 support and guide the white keys 21. The white and black keys at their forward ends are provided with plastic shells 35 and 36, respectively. A felt strip 37 may underlie the finishing rail 19 and limit the upward movement of the keys.

The rear ends of the keys are supported, when at rest, upon a felt strip 38, secured to the rear portion 15 of the frame, and their upper surfaces carry felt pieces 39, underlying the hammers 40.

The hammers have curved undersurfaces 41, engaging the rear ends of the keys with a rolling, accelerated movement contact, as explained in the above mentioned application. In the present case,

the keys are preferably made of molded, plastic material and are of simple bar form. They are pivoted adjacent their rear ends to a rod 42 carried in apertures formed in the tines 43 of a comb structure 44, the tines serving to space the hammers apart, corresponding to the spacing of the keys and the vibratory rods hereinafter described.

The comb may be constructed by using two pieces of wood, 45 and 46, such as two $\frac{3}{8}$ " plywood strips, cutting grooves 47, 48 in their surfaces, inserting a continuous felt channel in the groove so formed, securing the sheets together, for instance by a thermo-setting resinous adhesive along the meeting faces 49, and then cutting the slots 50 with a gang saw or the like, leaving a plurality of individual felt bushings 51 in the laterally projecting, vertically disposed tines 43. Experience has shown that a wooden comb, constructed in this manner, particularly when moisture-proof plywood is used, is very efficient, will not warp, and is particularly indestructible in use. The felt bushings in the individual tines, produced in this manner, are quite inexpensive and provide an admirable support for the rod 42 upon which the individual hammers are pivoted.

A tone bar 55, preferably constructed of cast iron has a flange 56, secured to the undersurface of the top wall 11 of the resonant case by bolts 57, with collars 58 interposed between the case and the flange. The collars may be integral with the flange 56 of separate elements, as desired, and the bolt heads may extend entirely through apertures in the case or may be disposed in molded bosses, as described in the above mentioned application.

A plurality of steel spikes or vibratory rods 60, having the physical structure described in detail in the above mentioned application, are secured at their forward ends 61 to the tone bar 55, by a clamping bar 62 and suitable screws 63. The rods, of varying length, vibrate at predetermined frequencies and produce the notes of the scale. Each rod is vertically aligned with one of the hammers 40 so that the striking cushion of hard felt 40a carried thereby will engage the reduced neck 64 thereof.

Secured to the rear surface 65 of the back bar of the comb 44 is a sheet of spring metal 66, having a slotted upper portion providing a plurality of upwardly and forwardly projecting spring fingers 67, each of which is aligned with one of the vibratory rods 60, and each of which carries, adjacent its free end, a felt block or cushion 68, having a V-shaped groove 69 in its upper surface, positioned to engage the aligned rod 60, as shown in Figures 1 and 4, to dampen the vibrations set up in the rod. Each spring finger is slotted as at 70, to provide an upwardly projecting prong or barb 71, constituting a securing means for the upper end of a flexible strap 72, the lower end of which is wrapped partially around and secured to the rear end face 40b of the associated hammer 40. Hence, it will be apparent that, when the key is oscillated in a clockwise direction, so that the forward end rises to strike a note, the rear end face moves downwardly, thereby pulling the associated spring finger downwardly and withdrawing the cushion 68 from the associated rod 60, and permitting the rod to vibrate and hold the note, until the key is released. When the key returns to its normal position shown in full lines in Figure 1, the spring finger rises, carrying the cushion block 68 into contact with the rod, thereby dampening the vibrations.

The sheet 66 and the spring fingers 67 are pref-

erably made from aluminum or aluminum alloy of the proper thickness and hardness to impart to the fingers just enough tension to press the cushion members 68 against the rod 60 with sufficient firmness to promptly dampen vibrations therein, yet to apply minimum strain or resistance to movement of the hammers 40 and keys 21. No more force than is required to dampen the vibrations in the rods should be applied to the cushions by the spring fingers. The strap connections between the spring fingers and the hammers perform the additional function of urging the hammers downwardly so as to maintain a positive contact between the bottoms of the hammers and the keys at all times, except after the rear ends of the keys have reached their upper limit of movement and the hammers continue their travel upwardly, under the momentum imparted thereto by the keys, to strike the bars. The spring fingers and the strap connections with the hammers also hasten the return of the hammers to their positions in contact with the keys. Thus, this structure very materially speeds up the repeating action.

It will be understood that, as soon as a key is depressed and the hammer slightly raised, the associated spring finger and cushion are depressed and the rod is free to vibrate. This condition remains, as long as the key is held depressed, but the dampening action occurs immediately, when the key is released and the key and hammer have assumed their normal positions.

It has been found advantageous to employ steel rods as the vibrating elements, instead of the beryllium-copper alloy previously suggested, although the invention is not limited to specific materials in this connection.

Pivotaly secured in bosses 75 formed in the side walls of the casing, or supported from suitable pedestals mounted on the base, is a rod 76, extending transversely above the spring finger 67. The rod carries a forwardly projecting member, in the form of a vane or wing 78, having a felt strip 79 on its forward edge. A crank arm 80, fast on the shaft 76 may have its free end connected to a Bowden wire 81, comprising a flexible tube 82, connected at one end to the base 15 and at the other to a bracket 83 for a foot pedal 84, the free end of which is connected to the other end of wire 81. Of course, any other actuating mechanism could be employed and the one shown is simply typical of many alternatives. When the rod 76 is oscillated, by whatever means employed, so as to depress the forward edge of the vane or wing 78, the latter depresses all of the spring fingers 67 and moves all of the cushion blocks 68 out of contact with the vibratory rods 60, thus giving a sustaining action, the equivalent to the sustaining pedal action of a conventional piano.

It will be understood that the piano action and vibration dampening mechanism described above may be used with conventional pianos, including the usual sounding board, harp and piano strings; that the cushion blocks 68 will normally be pressed into vibration dampening relation with the strings of the harp, and that they will be withdrawn upon movement of the hammers 40 into striking relation to the strings. The sustaining pedal action may be substantially identical as described above, so that all of the springs 67 may be shifted simultaneously, to maintain all the cushions 68 out of contact with the strings for the desired period of time.

The invention is not limited to the specific

5

details of construction shown in the accompanying drawings and described above, but includes modifications coming within the scope of the appended claims and their equivalents.

I claim:

1. In a piano of the type wherein a tone bar having a plurality of vibratory rods carried thereby is secured to the undersurface of a resonant case, a plurality of piano action assemblies for the rods, each assembly comprising a key pivoted intermediate its ends and projecting forwardly and rearwardly, a hammer pivoted adjacent its rear end, projecting forwardly and having a curved undersurface lying upon the rear end of the key, a spring finger projecting into proximity to the corresponding rod, a cushion carried by the free end of the spring and a flexible strap connection between the spring and the rear end of the hammer beyond the pivot thereof, whereby, when the upward swinging movement of the forward end of the hammer commences, said connection moves downwardly to withdraw the cushion from the rod.

2. In a piano of the type wherein a tone bar is secured to the undersurface of a resonant case, and wherein a plurality of vibratory rods are carried by the bar, means for creating and controlling the vibrations in the rods, comprising a hammer supporting shaft within the case, a plurality of hammers pivotally secured to the shaft for upward swinging movement to strike the rods, a plurality of spring fingers projecting upwardly into proximity with the rods, a cushion element carried by each finger, a key below each hammer for swinging the same upwardly to strike the associated rod and tension connection means between the rear, downwardly swinging end of each hammer and the associated spring finger, whereby upward swinging movement of the hammer depresses the associated spring finger and withdraws the cushion from the rod.

3. In a piano of the type wherein a tone bar is secured to the undersurface of a resonant case, and wherein a plurality of vibratory rods are carried by the bar, means for creating and controlling the vibrations in the rods, comprising a hammer supporting comb within the case, a plurality of forwardly projecting hammers pivotally supported by the comb for upward swinging movement to strike the rods, a plurality of spring fingers having their free ends positioned adjacent the rods, a plurality of cushions carried by the fingers, a key below each hammer for swinging the same upwardly, and a flexible strap connection between the rear end of each hammer and the associated spring finger, whereby upward swinging movement of the hammer depresses the spring finger and withdraws the cushion.

4. In a piano of the type wherein a tone bar is secured to the undersurface of a resonant case, and wherein a plurality of vibratory rods are carried by the bar, means for creating and controlling the vibrations in the rods, comprising a hammer supporting comb within the case, a plurality of forwardly projecting hammers pivotally supported by the comb for upward swinging movement to strike the rods, a plurality of spring fingers secured to the back of the comb and projecting forwardly with their free ends positioned adjacent the rods, a plurality of cushions carried by the fingers, a key below each hammer for swinging the same upwardly, and a flexible strap connection between the rear end of each hammer and the associated spring finger, whereby upward

6

swinging movement of the hammer depresses the spring finger and withdraws the cushion.

5. In a piano of the type wherein a tone bar is secured to a resonant case and wherein a plurality of vibratory rods are carried by the bar, means for creating, controlling the duration of, and dampening the vibrations in the rods, comprising a wooden comb supported within the case, a shaft extending through aligned apertures in the tines of the comb, felt bushings in the apertures embracing the shaft, a plurality of forwardly projecting hammers pivoted on the shaft and spaced apart by the tines, a plurality of leaf spring fingers secured to the back of the comb and projecting upwardly and forwardly with their free ends positioned adjacent the rods, a cushion member carried by each finger below and normally in contact with the adjacent rod, a key below each hammer for swinging the same upwardly to strike the associated rod, and a plurality of flexible strips each having one end connected to one finger and the other end connected to the rear end of the associated hammer, whereby upward swinging movement of the hammer depresses the associated finger and withdraws the cushion.

6. In a piano of the type wherein a tone bar is secured to a resonant case and wherein a plurality of vibratory rods are carried by the bar, means for creating, controlling the duration of, and dampening the vibrations in the rods, comprising a wooden comb supported within the case, a shaft extending through aligned apertures in the tines of the comb, felt bushings in the apertures embracing the shaft, a plurality of forwardly projecting hammers pivoted on the shaft and spaced apart by the tines, a plurality of leaf spring fingers secured to the back of the comb and projecting upwardly and forwardly with their free ends positioned adjacent the rods, a cushion member carried by each finger below and normally in contact with the adjacent rod, a key below each hammer for swinging the same upwardly to strike the associated rod, a plurality of flexible strips each having one end connected to one finger and the other end connected to the rear end of the associated hammer, whereby upward swinging movement of the hammer depresses the associated finger and withdraws the cushion, a member extending transversely across and above all of said spring fingers and means for shifting the member to depress all of the fingers and to withdraw all of the cushions simultaneously for sustaining pedal action.

7. In a piano of the type wherein a tone bar is secured to the undersurface of a resonant case, and wherein a plurality of vibratory rods are carried by the bar, means for creating and controlling the vibrations in the rods, comprising a hammer supporting comb within the case, a plurality of forwardly projecting hammers pivotally supported by the comb for upward swinging movement to strike the rods, a plurality of spring fingers having their free ends positioned adjacent the rods, a plurality of cushions carried by the fingers, a key below each hammer for swinging the same upwardly, a flexible strap connection between the rear end of each hammer and the associated spring finger, whereby upward swinging movement of the hammer depresses the spring finger and withdraws the cushion, and means common to all of the spring fingers, shiftable to withdraw all of said cushions simultaneously for sustaining pedal action.

8. In a piano of the type wherein a tone bar is

7

secured to the undersurface of a resonant case, and wherein a plurality of vibratory rods are carried by the bar, means for creating and controlling the vibrations in the rods, comprising a hammer supporting comb within the case, a plurality of forwardly projecting hammers pivotally supported by the comb for upward swinging movement to strike the rods, a plurality of spring fingers having their free ends positioned adjacent the rods, a plurality of cushions carried by the fingers, a key below each hammer for swinging the same upwardly, a flexible strap connection between the rear end of each hammer and the associated spring finger, whereby upward swinging movement of the hammer depresses the spring finger and withdraws the cushion, a member extending transversely across and in proximity to all of said fingers and pivoted off-center, and means for swinging the member to flex the springs and to withdraw all of the cushions simultaneously, for sustaining pedal action.

9. A piano comprising a resonant case, a tone bar firmly secured to the undersurface of said case, a plurality of vibratory rods supported by said bar and freely projecting therefrom in a rearward direction, a hammer supporting comb in the case below the rods, a plurality of forwardly projecting hammers pivotally connected adjacent their rear ends to the comb, a sheet of spring metal secured to the rear surface of the comb and having a plurality of forwardly projecting fingers, each aligned with a rod and having a free end positioned therebelow, a plurality of dampening cushions, one carried by each finger below a rod and having a grooved upper surface for contact with the rod, a plurality of keys below the hammers for swinging the latter upwardly to strike the rods, and a strap connected to the rear, downwardly movable end of each hammer and to the corresponding finger, to withdraw the cushion when the hammer swings upwardly.

10. A piano comprising a resonant case, a tone bar firmly secured to the undersurface of said case, a plurality of vibratory rods supported by said bar and freely projecting therefrom in a rearward direction, a hammer supporting comb in the case below the rods, a plurality of forwardly projecting hammers pivotally connected adjacent their rear ends to the comb, a sheet of spring metal secured to the rear surface of the comb and having a plurality of forwardly projecting fingers, each aligned with a rod and having a free end positioned therebelow, a plurality of dampening cushions, one carried by each finger

8

below a rod and having a grooved upper surface for contact with the rod, a plurality of keys below the hammers for swinging the latter upwardly to strike the rods, a strap connected to the rear, downwardly movable end of each hammer and to the corresponding finger, to withdraw the cushion when the hammer swings upwardly, a transversely extending vane positioned above all of said fingers and pivoted adjacent one edge, and means for swinging the other edge downwardly to depress all of said fingers and to withdraw all of the cushions, for sustaining pedal action.

11. A piano comprising a resonant case, a tone bar firmly secured to the undersurface of said case, a plurality of vibratory rods supported by said bar and freely projecting therefrom in a rearward direction, a hammer supporting comb in the case below the rods, a plurality of forwardly projecting hammers pivotally connected adjacent their rear ends to the comb, a sheet of spring metal secured to the rear surface of the comb and having a plurality of forwardly projecting fingers, each aligned with a rod and having a free end positioned therebelow, a plurality of dampening cushions, one carried by each finger below a rod and having a grooved upper surface for contact with the rod, a transversely extending fulcrum rail disposed forwardly of the comb, a series of pins projecting upwardly from the rail, a second series of upwardly projecting pins spaced forwardly of the first end aligned therewith, a plurality of keys fulcrumed on said rail and each having a bottom aperture and a communicating, longitudinal guide slot closely embracing one of the first series of pins and another longitudinal guide slot spaced forwardly therefrom and receiving a pin of the other series, the keys having rear ends underlying the hammer, and a plurality of straps, each connected to the rear end of one hammer and to the corresponding finger, to depress the finger and withdraw the cushion when the forward end of the hammer swings upwardly.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,490,476	Morris	Apr. 15, 1924
2,244,332	Finney	June 3, 1941