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TONE-MODIFYING MEANS FOR PIANOS.

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To all whom it may concern:

Be it known that I, IRVING B. SMITH, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Tone-Modifying Means for Pianos, of which the following is a specification.

My present invention relates to tone-modifiers or pianissimo devices for pianos, and is more especially adapted for use in connection with pianos having a self-playing attachment embodied therein or in connection with pianos operated by external piano-players; and the object of the invention is to provide a device of the character described that is simple in construction, easy and effective in operation, and readily attachable to pianos now in use without in any manner altering the construction thereof.

In endeavoring to secure pianissimo effects on a piano operated by a self-playing attachment or by an external self-player some difficulty is encountered as soon as it is attempted to also obtain rapid repetition. For example, if a repetition of, say, six hundred or eight hundred notes per minute is desired this is difficult to get owing to the rapid movement that must of necessity be imparted to the various parts of the mechanism both in the piano-player and in the piano-action proper. This will be more fully appreciated when it is considered that in a piano the hammer and key together form two members in quite a long train of mechanism, the hammer being the actuated member and the key the actuating member. Now these various parts are impelled by one or two forces to return to their position of rest after sounding a note. Considering first the key, this element is usually so weighted that the front end is slightly the heavier, and consequently it relies upon the balance of the train of mechanism to return it to its position of rest. On the other hand, the parts of the mechanism between the hammer and the key are forced by gravity to return to their downward or rest position. If now the hammer proper is considered, it will be seen, first, that this element is assisted by a very weak spring, and, furthermore, its gravi-

tative force is very small, owing to the fact that the center of gravity of the key is so nearly over the pivotal point upon which the key turns. As a result it will be seen that the one element in the train least active to return to rest is the hammer. This will be especially apparent and may be readily demonstrated by striking a piano-key and then watching the various parts of the piano-action come to rest or assume their normal position.

It has been demonstrated under practical working conditions that by placing a spring back of the hammer "handle" or "stem" in the manner hereinafter to be made clear it is not necessary to lessen or weaken the force of the blow upon the hammer in order to lessen or weaken the sound. On the contrary, a hard blow on the hammer will through the medium of the opposing spring cause a light blow on the string and result in a soft tone being given off. In other words, when a spring opposes the action of the hammer movement, however strong the force of the blow upon the hammer, this force will be partly expended or absorbed by the spring (through its bending action) and the blow struck upon the string will be light. Again, the bent spring represents potential energy stored up and ready to assist in the rapid return of the hammer, which is a desideratum of considerable importance.

The advantage of locating a spring so that it opposes the movement of the hammer in one direction and assists in its movement in the opposite direction over such arrangements where a spring opposes a striker-lever that operates directly on the piano-key will be evident when it is considered that it is the hammer itself that is slow in action, and it is the means for opposing and assisting the movement of the hammer that constitutes one of the salient features of this invention.

Another important feature of the invention resides in the peculiar manner of mounting and operating the hammer-opposing springs so that they may be caused to exert different degrees of opposition to the different hammers of the series or bank, whereby to secure a progressively increasing or decreasing tone volume at different points along the range of

strings, either in the treble, the bass, or the middle, thus enabling the performer to obtain at will crescendo or diminuendo effects, to accent a note or group of notes at any point throughout the range of strings, to bring out or accent the air or melody and subdue the accompanying parts, to wave a trill, and to secure many other pleasing and artistic musical effects.

10 In order to enable others to clearly understand the invention and to practice the same, I will now describe one embodiment of means for accomplishing the ends in view, reference being made to the accompanying drawings, 15 in which---

Figure 1 is a view, partly in section, of a part of an upright piano, showing my improvements applied thereto, the piano being shown as operated by a playing attachment 20 and also by an external player. Fig. 2 is a top plan view of the means for operating the tone-modifier or pianissimo device. Fig. 3 is a front elevation of the same. Fig. 4 is a diagrammatic view showing the normal position of the bank or series of opposing springs 25 relatively to the hammer-stems. Fig. 5 is a similar view showing the position of the springs when the treble notes are to be accented and the bass and part of the middle notes subdued. Fig. 6 is a similar view showing the position of the springs when the bass notes are to be accented and the treble and part of the middle notes subdued. Fig. 7 is a like view showing the position of the springs 35 when both the treble and bass notes are to be gradually accented from the middle toward the highest treble and lowest bass. Fig. 8 is a like view showing the position of the springs when the middle notes are to be accented and the bass and treble gradually subdued; and 40 Fig. 9 is a side elevation of a piano-hammer, showing a slightly-different application of the opposing spring.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference-numeral 1 indicates part of a piano-case below the keyboard; 2, one of the piano-keys; 3, the piano-strings; 4, the piano-action of any well-known type in which is embodied the hammer 50 5, mounted upon the hammer-stem 6, and having the usual back-check 7. In the present instance I have shown the piano-key 2 as being actuated through the medium of an internal self-playing attachment in which is embodied 55 a striker-rod 8, adapted to impinge the rear end of the piano-key 2, and have also shown an external piano-player embodying a case or cabinet 9 and striker-levers 10, which overhang the front ends of the keys 2, said striker-levers 10 being actuated from any of the well-known means, such as power-pneumatics. (Not shown.)

I will now proceed to describe the tone-modifying means, which comprises the essential 65 feature of this invention.

Arranged transversely of the piano, at a point adjacent to the hammers, in any convenient manner, is a bar or rail 12, to the upper face of which is pivoted three levers 13, 14, and 15, the lever 13 being pivoted at 16, the 70 lever 14 being pivoted at 17, and the lever 15 being pivoted at 18. Separate springs 19, as shown in Fig. 2, are arranged to normally exert pressure against the levers 13, 14, and 15 for a purpose presently to be explained, the 75 levers being restrained or held against movement in one direction or in the direction opposing the force of the springs by means of stop-pins 20. Projecting upward or vertically from one end of each of the levers 13, 80 14, and 15 is a pin or stud 21, each having a collar 22, and fitted over these pins or studs and resting upon the collars are two bars or bar-sections 23 and 24, the outer ends of which are provided with apertures to receive the 85 pins or studs on the levers 13 and 14 and the inner or adjacent ends of which are stepped and apertured to receive the pin or stud on the lever 15. Secured to and projecting upward from each of the bar-sections 23 and 24 is a 90 plurality of forwardly-bent spring-blades 25, one for each piano-hammer, the bent ends of said spring-blades normally lying in front of and preferably in contact with the stems 6 of the piano-hammers, the arrangement being 95 such that the springs will oppose the movement of the hammers as they advance to strike the strings, the effect of this being to lessen the force of the blow on the strings and cause a soft note to be sounded. It will be apparent 100 that if the bar-sections 23 and 24, or either of them, is moved toward the strings or away from the hammer-stems the springs will offer less resistance to the movement of the hammers, and thus enable the latter to strike a 105 sharper blow against the strings. Furthermore, it will be apparent if the bar-sections are moved so as to occupy the position shown in dotted lines in Fig. 1 then the springs will offer no resistance whatever to the movement 110 of the hammers and a full blow will be struck. Again, it will be observed if the bar-sections are moved so as to assume a position at an angle to the plane of the strings or to the plane of the line of hammer-stems then the opposi- 115 tion or resistance offered to the force of adjacent hammers will vary progressively or to different extents from hammer to hammer either toward the bass, the treble, or the middle of the piano-keyboard or range of piano- 120 strings. I have provided means for giving these various movements to the bar-sections and hammer-opposing springs, and it is this that constitutes one of the most important features of the invention. The means referred 125 to will now be described.

By referring to Fig. 2 of the drawings it will be seen that one end of each of the levers 13, 14, and 15 terminates at about substantially the same point, and to each of the said ends is 130

secured a cord or strap 26, the said cords or straps passing over separate pulleys 27, journaled in brackets 28, secured to the transverse bar or rail 12, and the other end of each cord or strap being secured to a lever 28', there being one for each cord, said levers each having a finger piece or button 29, bearing, respectively, the letters "B," "M," and "T," the letter "B" representing the bass hammers or strings of the piano, the letter "M" indicating the middle hammers or strings of the piano, and the letter "T" indicating the treble hammers or strings of the piano. The operation of this part of the device is as follows:

As will be seen by referring to Fig. 4 of the drawings, all of the opposing springs are positioned so as to have a uniform bearing against the hammer-stems 6, so that the action of the hammers when moved will be opposed to the same extent, the springs also acting to assist in the return of the hammers after they have struck the strings. If now it is desired to accent the notes in the treble of the piano, the lever 28' having the finger-button with the character "T" thereon will be depressed, and this will cause the lever 14, through the cord 26, to be rocked on its pivot 17, so as to throw the outer end of the bar-section 24, with its opposing springs, outward or toward the strings and away from and at an angle to the line of hammer-stems, as more clearly shown in Fig. 5. This will result in bringing the springs that cooperate with adjacent hammers in the treble and a part of the middle of the piano at gradually-increasing distances from the middle string of the piano outward toward the highest string of the treble, so that the tones thus given off will vary gradually, whereby a crescendo effect will be produced. In view of the fact that the bar-sections are pivotally connected at their adjacent ends and provided with separate operating means it will be seen that the movement of the section 24 just described will have no effect on the bar-section 23. Hence all the hammers in the bass and a part of the treble will be opposed uniformly by the springs carried by said bar-section 23, and these notes will thus be sounded with pianissimo effect. By depressing the lever 28' having the finger-button bearing the character "B" the same action will take place with regard to the bass notes of the piano, as illustrated in Fig. 6. If now it is desired to accent both the bass and treble notes and at the same time subdue the notes in the middle range of the keyboard, the two levers 28' bearing the characters "T" and "M" will be simultaneously depressed, which will move the bar-sections and their opposing springs to the positions indicated in Fig. 7. If, on the other hand, it is desired to accent the middle notes and gradually subdue the bass and treble, the lever 28' carrying the button with the character "M" thereon will be depressed, and this will shift the two bar-

sections 23 and 24, with the opposing springs 25, to the position indicated in Fig. 8, in which the bass and treble notes will be gradually subdued from a point near the middle outward and the notes of the middle range will be accented. It will be apparent that a number of different combinations may be secured by variously operating the three levers 28' and also that the degree of opposing force of the strings can be varied according to the amount of depression given to the levers 28'.

In order to provide for the operation of the levers 28' from the well-known external type of piano-player, as illustrated at 9 in Fig. 1, I provide players of this type with suitable lever mechanism, shown in the present instance as a bell-crank lever 30, pivoted at 31 and having its free end 32 arranged to be positioned directly over the finger-buttons 29 of the levers 28'. It will be apparent that three of these bell-crank levers will be employed, one for each of the three levers 28', and that the movement of the bell-crank levers 30 in the direction of the arrow in Fig. 1 will depress the levers 28' to move the bar-sections 23 and 24 and their springs in the proper direction, the said sections being returned to normal position by means of the springs 19.

I do not wish to be understood as limiting myself to the arrangement shown in Fig. 1, wherein the springs act directly upon the hammer-stems, as they may be arranged to act upon some other part of the hammer—as, for instance, upon the back-check 7, as shown in Fig. 9. In this case the bar-sections 33, of which there are two, as before described, carrying the springs 34, as shown in Fig. 9, will be moved vertically at an angle to the line of back-checks instead of horizontally toward and from the hammer-stems, as shown in Fig. 1. Neither do I wish to be understood as limiting myself to the precise construction of means herein shown and described for actuating the bar-sections, for it will be obvious that other means may be employed without departing from the spirit of the invention as heretofore described.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a tone-modifying device for pianos, the combination with the piano-hammers, of springs opposing the action of said hammers, and means for varying, to different extents, the opposing force of the springs of adjacent hammers.

2. In a tone-modifying device for pianos, the combination with the piano-hammers, of resilient means for opposing the action of said hammers, and mechanism for varying to different extents, the opposing force of said means on adjacent hammers.

3. In a tone-modifying device for pianos, the combination with the piano-hammers, of means arranged to bear against a part of said

hammers to oppose the action thereof and assist in their return to normal position, and mechanism for varying, to different extents, the opposing force of said means on adjacent
5 hammers.

4. In tone-modifying means for pianos, the combination with the piano-hammers, of springs opposing the action of said hammers, and means under the control of the performer,
10 for varying to different extents, the opposing force of the springs cooperating with adjacent hammers in the treble part of the piano.

5. In tone-modifying means for pianos, the combination with the piano-hammers, of
15 springs opposing the action of said hammers, and means under the control of the performer, for varying to different extents, the opposing force of the springs cooperating with adjacent hammers in the bass part of the piano.

20 6. In tone-modifying means for pianos, the combination with the piano-hammers, of springs opposing the action of said hammers, and means under the control of the performer, for varying to different extents, the opposing
25 force of the springs cooperating with adjacent hammers in the middle range of the piano.

7. In tone-modifying means for pianos, the combination with the piano-hammers, of means arranged to be brought to bear against
30 a part of said hammers to oppose the action thereof and assist in their return to normal position, and mechanism under the control of the performer, for varying to different extents, the opposing force of a portion of said means
35 cooperating with some of the adjacent hammers of the bank independent of others.

8. In tone-modifying means for pianos, the combination with the piano-hammers, of piv-
40 otally-connected bar-sections each section carrying a plurality of blade-springs one for each hammer, arranged to bear thereagainst to oppose the action thereof, and means under the control of the performer for pivotally moving either end
45 of either bar-section to vary the distance to different extents between adjacent hammers and springs.

9. In tone-modifying means for pianos, the combination with the piano-hammers, of piv-
otally-connected bar-sections each section carrying a plu-

50 rality of blade-springs one for each hammer arranged to bear thereagainst to oppose the action thereof, and means under the control of the performer for pivotally moving the bar-sections to vary to different extents the distance between adjacent hammers and their co-
55 operating springs.

10. In tone-modifying means for pianos, the combination with the piano-hammers, of piv-
otally-connected bar-sections each section carrying a plurality of blade-springs one for each
60 hammer arranged to bear thereagainst to oppose the action thereof, three pivoted levers carrying said bar-sections, and means for actuating said levers to move the bar-sections in the manner and for the purpose described.
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11. In tone-modifying means for pianos, the combination with the piano-hammers, of piv-
otally-connected bar-sections, a plurality of blade-springs, one for each hammer, carried
70 by said bar-sections, three pivoted levers upon which said bar-sections are pivotally mounted, springs acting upon said levers to resist movement thereof in one direction, and means under the control of the performer for actuating
75 either of said levers at will for the purpose specified.

12. In tone-modifying means for pianos, the combination with the piano-hammers, of piv-
otally-connected bar-sections, a plurality of blade-springs one for each hammer, carried
80 by said bar-sections and arranged to oppose the striking action of the hammers, a rail located transversely of the piano, three levers separately pivoted to said rail and carrying projecting pins which pass through separate
85 apertures in the said bar-sections, manually-operable levers pivoted to the piano beneath the keyboard thereof, and separate connections between said first-named levers and the manually-operable levers.
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In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

IRVING B. SMITH.

Witnesses:

GEO. Z. SUTTON,
LINDA COPE SMITH.