

UNITED STATES PATENT OFFICE.

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PIANO.

SPECIFICATION forming part of Letters Patent No. 667,438, dated February 5, 1901.

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To all whom it may concern:

Be it known that I, SIMON A. HAGEMAN, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful
5 Improvements in Pianos and other Musical Instruments, of which the following is a specification.

My invention relates to pianos and organs, its object being to provide a system of mechanism whereby the defects of the scale incident to those instruments whose tones are fixed throughout an extended series may be corrected for any key or succession of keys of the music being performed thereon and the
10 instrument thereby rendered perfectly harmonious for the time being in relation to such keys, thereby achieving what is known among musicians as "just intonation."

It consists in the details of mechanism for
20 accomplishing this object whereby the entire apparatus is simple, easily applied, and rendered convenient, efficient, and durable in action.

Mechanism embodying my invention as applied to an ordinary "upright" piano is illustrated in the accompanying drawings, in which—

Figure 1 is a partial rear elevation, and Fig. 2 an end elevation, of an upright piano, showing my invention applied thereto. Fig. 3 is an enlarged perspective view at the rear, showing details of construction. Fig. 4 is a detail front view of the lever connections operating the movable stops or pitch-modifiers.
35 Fig. 5 is a cross-section of the movable stop or pitch-modifier; Fig. 6, a perspective view of the shifter or assembler with its jaw members separated to show construction; and Fig. 7 an enlarged detail cross-section of the connecting-bars, showing their connection with the shifters.
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Referring now to the drawings, A designates the body or frame of the piano, and *a* its strings or "unisons." My invention being
45 applicable as an independent attachment or addition the construction of the piano in all ordinary respects will be herein assumed without detailed description and the defects of its scale assumed to be known. The piano
50 is assumed also to be tuned and the relative imperfections of pitch distributed, as is usual, by "equal temperament."

To correct the inequalities of pitch, let there be supposed to be placed in contact with each string or set of unisons a movable bridge or
55 "pitch-modifier" *b*, movable toward or from the permanent bridge upon the wrest-plank or frame and constructed and operated as follows: The pitch-modifier *b* consists of a piece of metal placed beneath and extending across
60 the group of strings *a*, Figs. 2, 4, and 5, and bearing up against the strings with sufficient pressure to constitute a limit of vibration. The stop *b* moves upon a metal support and
65 guide *c'*, consisting of a short steel bar seated upon the iron frame or the wrest-plank. To the stop *b* I attach a link *d*, pivoted above to a crank-arm *e*, radially attached to a cross-shaft *f*, journaled across the top of the piano-body and provided with operating mechanism, presently to be described. The arms *e*
70 (front levers) are of lengths proportioned to the lengths of the strings, thus compensating for the difference of length of the different unisons.
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Each string or unison of the piano being similarly provided and all the pitch-modifiers being set close to and parallel to the permanent bridges on the wrest-plank or iron frame, the piano may be tuned and used as
80 though no pitch-modifiers were present. It will be obvious that by temporary adjustment of certain of the pitch-modifiers throughout the register of the instrument, whereby the vibrating length of the strings affected is
85 slightly increased or diminished, as required, any defects of relative pitch may be corrected, and to this end each string is provided with a pitch-modifier, as explained, provided with actuating mechanism, as follows: The
90 several cross-shafts *f* are arranged in parallel relations, and to each one, at its rear extremity, is attached a radial arm or lever *g*, depending vertically at the rear of the piano, and each radial arm is pivotally connected
95 by a wrest-pin with and constitutes a support and guide for a horizontal strip *h* or connecting-bar which extends entirely across the piano-frame. The connecting-bars *h* (twelve in number) correspond with the whole and
100 half tones of the chromatic scale and are arranged in two banks with space between for the reception and play of a series of shifters or assemblers *i*, each consisting of two oppo-

site members or jaws formed somewhat like those of a pair of clipping-shears and hung upon a common pivot, there being also twelve of said shifters and one additional shifter 5 whose function will be explained later.

The pivotal jaws of the shifter devices *i* (shown in perspective in Fig. 6) are alike in structure and are hung in opposite relations in pairs upon certain of the shafts *f*, as may 10 be convenient, and project down between the banks of couplers *h* and are of such form that when closed their proximate edges are brought into parallel relations with their outer edges converging downwardly. Beneath these in 15 the same vertical line each with each are arranged a corresponding number of vertically-movable rods *K*, guided in a suitably-constructed framing *K*², each rod being terminated above by an enlarged head *K'* with a 20 V-shaped recess, whose upwardly-diverging surfaces engage the converging ends of the shifter-jaws, and by upward movement between the banks of connecting-bars closes the jaws of the shifter together. Each rod *K* is 25 attached to and actuated by a foot-lever *l*, pivoted to the under side of the piano-frame and carried forward to convenient reach of the performer's foot, (or hand, as desired.) Each of the connecting-bars *h* is provided at its in- 30 ner side with a set of pins *x*, projecting approximately midway into the space between the banks and between the opposite jaws of one or other of the shifters *i*, there being thirteen pins in all to each connecting-bar, twelve 35 between each pair of the shifter-jaws—that is, one for each connecting-bar.

The general construction of the mechanism being understood, it may be explained that 40 each of the connecting-bars *h*, by its supporting-arm *g*, cross-shaft *f*, crank-arm *e*, and link *d*, controls a pitch-modifier *b* beneath each string or set of unisons of the same designating letter throughout the register of the instrument, whereby the movement of any 45 pitch-modifier in relation to a given string is accompanied simultaneously by a similar movement of all other pitch-modifiers *b* of similarly-lettered strings, so that when the pitch of a given tone is elevated or depressed 50 all octaves of the tone are likewise affected.

The pins *x*, projecting inwardly from the connecting-bars *h* between the jaws of the shifters *i*, are so placed in relation to the connecting-bars and shifters that when the jaws 55 of a given shifter are closed together by the upward thrust of one of the heads *K'* all the pins *x* at that point are assembled in a common plane and all the connecting-bars of the entire series are moved, if required, into a 60 position wherein the pitch-modifiers *b* regulate the relative pitch of all tones of a given scale, increasing or diminishing the vibrating length of certain strings, so as to bring them into exactly harmonious relations for 65 that scale or key throughout the entire instrument. There being twelve shifters, each

devoted to a scale or "key" based upon a given tone or semitone of the ordinary diatonic scale as its tonic and each shifter having its appropriate pedal, the piano may be adjust- 70 ed instantly to any desired key or the adjustment instantly changed to any other key, or by the thirteenth shifter previously referred to (with attachments constructed and ar- 75 ranged in the manner described) the instrument may be instantly restored to its normally-tempered condition.

The pedals are preferably provided with springs *s* to restore them to their normal position after use; but the connecting-bars *h* 80 and the pitch-modifiers *b* remain in whatever position they may be placed until moved by readjustment for another key or restored by the "even temper" or thirteenth pedal to the neutral position first herein described. By 85 the latter device the player, if confused or in doubt as to the changes of key, may always restore the piano to the even temperament.

I claim as my invention and desire to secure by Letters Patent of the United States— 90

1. In a piano or similarly "tempered" stringed instrument, a series of adjustable pitch-modifiers arranged to traverse the strings or unisons respectively, and by adjustment to increase or diminish their vibrating 95 length; and a series of connecting-bars mediately attached thereto; in combination with a corresponding series of assemblers or adjusting devices adapted to engage and adjust the relative positions of the connecting-bars, 100 and thereby the pitch-modifiers; and actuating devices for the assemblers adapted to be used selectively; whereby the connecting-bars and pitch-modifiers may be adjusted as desired, to regulate the tone intervals for any 105 musical key at will, substantially as set forth.

2. In combination with a piano, a series of "pitch-modifiers" arranged to traverse the strings respectively to increase or diminish 110 their vibrating lengths; a series of movable connecting-bars with connections uniting them in octaves; a series of assembling or adjusting devices corresponding with the connecting-bars; actuating devices adapted to adjust the relative positions of the connect- 115 ing-bars and thereby the positions of the pitch-modifiers whereby the vibrating lengths of the strings may be readjusted for any key, changeable at will, and an additional actuating device for reassembling the connecting- 120 bars from any adjusted position back to the original or "tempered" position common to all the keys, substantially as set forth.

3. In a system of mechanism for altering the pitch-intervals of a piano or similar tem- 125 pered instrument, the combination of the strings, a series of movable stops for altering the vibrating length of the strings, and a corresponding series of operating-levers connected therewith, and provided with means 130 for their oscillation through a common radial angle, said levers being of successively-in-

creased length proportioned to the different lengths of the strings, substantially as set forth.

4. In a system of mechanism of the character indicated, in combination with the pitch-modifiers moving in the longitudinal direction of the strings a system of levers connecting the same with a series of operating bars or strips moving in a direction across the line of the strings, and a series of shifters or assemblers actuated by hand or foot pedals to actuate the operating bars or strips, substantially as and for the purpose set forth.

5. In a system of mechanism of the character indicated in combination with the pitch-modifiers and their lever connections, a series of superimposed operating-bars provided with lateral pins or studs and a series of shifters adapted to engage the studs and assemble them in the same vertical line, thereby shifting the pitch-modifiers to predetermined relative positions, substantially as set forth.

6. In a system of mechanism of the character indicated in combination with the pitch-modifiers and their lever connections a series of parallel operating-bars provided with lateral pins or studs in "sets," a series of shifters embodying two opposite pivoted members normally resting at opposite sides of a given set of studs and adapted to be closed in toward each other bringing the set of studs into a common plane substantially as and for the purpose set forth.

7. In a system of mechanism of the character indicated, in combination with the pitch-modifiers and the lever connections, a series of parallel operating-bars superimposed in two opposite banks, and provided with sets of studs projecting into the space between a series of shifters or assemblers pivotally suspended above and projecting into the space between the banks at both sides of each set of studs, and means for actuating the shifters to engage each set of studs alternately and assemble them in a common plane, substantially as and for the purpose set forth.

8. In a system of mechanism of the character indicated, embodying pitch-modifiers, their lever connections and the operating-bars provided with lateral studs, a shifting device consisting of two pivotally-suspended members arranged at opposite sides of a given set of studs, having outward surfaces converging downwardly and adapted to close together upon the studs and assemble them in a common plane, in combination with a vertically-movable head having opposite jaws adapted to engage the outer surfaces of the shifter and close the members together, substantially as set forth.

9. In an upright piano, the combination of a foot-lever *l*, connecting-rod *K*, head *K'*, shifter *i i*, a series of connecting-bars *h*, levers *g*, shafts *f*, levers *e*, connecting-rods *d*, and movable stops or pitch-modifiers *b*, operating upon the strings or unison *a*, substantially as and for the purpose set forth.

10. In mechanism of the general character indicated, the combination and arrangement of the laterally-movable bars *h*, the levers *g*, by which they are suspended and through which their movement is transmitted to the pitch-modifiers, the shifters or assemblers *i i*, and the vertically-movable jaws or heads *K'*, substantially as set forth.

11. In mechanism of the general character indicated, the combination and arrangement of the movable bars *h*, suspended from the lateral shafts *f*, upon the levers or radius-arms *g*, in two opposite banks, the shifters suspended from the shafts *f*, between the banks and the actuating-heads *K'*, projecting into the space between the banks, both shifters and actuating-heads being held between the banks as guides, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

SIMON A. HAGEMAN.

Witnesses:

L. M. HOSEA,

HERBERT J. ALLSUP.