(No Model.)

R. T. SMITH.

KEY BOARD PLAYER.

No. 346,239. Patented July 27, 1886.

Fig. 1.

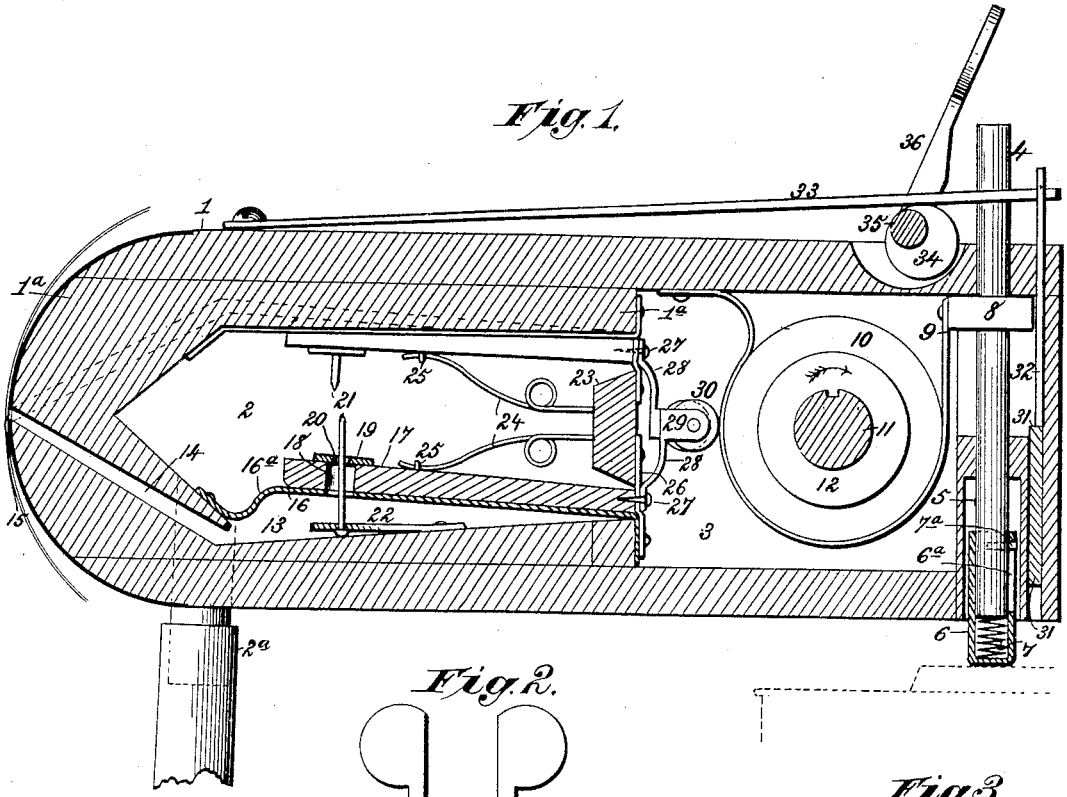


Fig. 2.

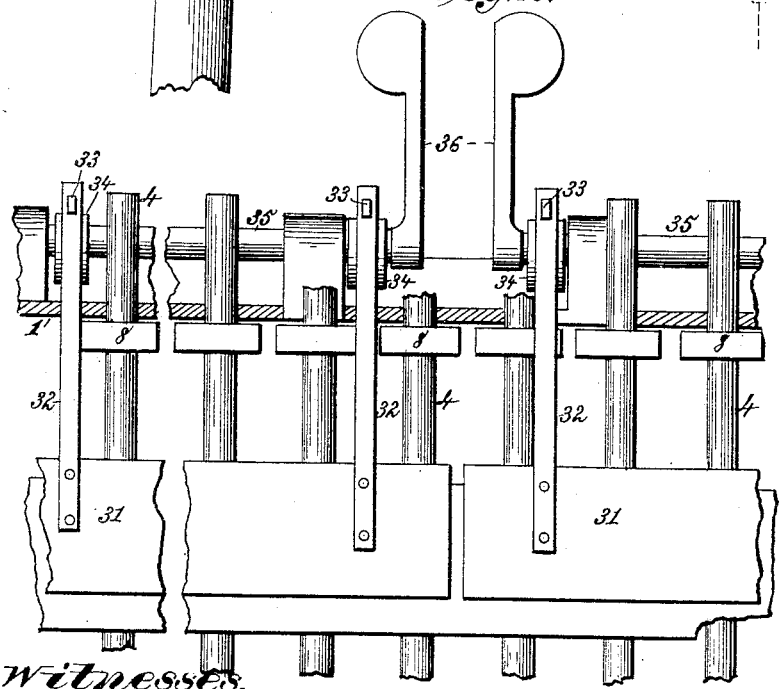
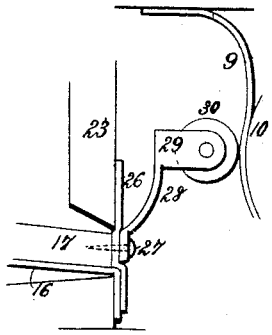


Fig. 3.



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UNITED STATES PATENT OFFICE.

ROSWELL T. SMITH, OF NASHUA, NEW HAMPSHIRE.

KEY-BOARD PLAYER.

SPECIFICATION forming part of Letters Patent No. 346,239, dated July 27, 1886.

Application filed August 26, 1885. Serial No. 175,361. (No model.)

To all whom it may concern:

Be it known that I, ROSWELL T. SMITH, a citizen of the United States, residing at Nashua, in the county of Hillsborough and State of New Hampshire, have invented certain new and useful Improvements in Apparatus for Operating Keyed Musical Instruments; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to that class of apparatus commonly known as "key-board instruments," for operating automatically keyed musical instruments—such as pianos, organs, and the like.

It is the purpose of my invention to provide simple means whereby the force of the stroke of the actuating-fingers may be varied at will throughout the entire series simultaneously, or over a portion of the range only, thereby modifying the expression of the music produced, according to the requirements of the score or the taste of the player.

It is also the purpose of my invention to simplify and improve the construction and operation of mechanism of this class with the view of rendering it operative by the usual air-exhaust with the expenditure of a comparatively low degree of power.

The invention consists in the several novel features of construction and combinations of parts, hereinafter fully described and definitely pointed out in the claims annexed to this specification, the same being an improvement upon the invention shown and described in the several applications for Letters Patent of the United States filed by me as follows, viz: upon the 23d day of April, 1884, Serial No. 123,444; upon the 7th day of March, 1884, Serial No. 129,014, and two applications upon the 15th day of January, 1885, Serial Nos. 152,945 and 152,946.

Referring to the drawings forming part of this application, Figure 1 is a vertical longitudinal section showing the apparatus in position for operation. Fig. 2 is a partial end elevation of the interior mechanism, the casing being removed. Fig. 3 is a detail side elevation showing one of the alternating diaphragm-plates, its roll-carrier, and a portion of the actuating-pulley.

In the said drawings the reference-numeral 1 designates the casing of the instrument, in which substantially all of the principal operative parts of the mechanism are contained. The forward or outer end of this casing is rounded to permit the music-paper to pass readily over it. The interior is divided into a diaphragm chamber, 2, and a pulley-chamber, 3. Arranged within the latter, at its rear end and extending from side to side of the casing, is a series of vertical bars or strikers, 4, their upper extremities passing through and having bearing in the upper wall of the casing, while the lower ends are inclosed by a series of separate cells, 5, having an interior diameter somewhat greater than that of the strikers. Within each cell is placed a thimble, 6, which receives the end of the striker, a spiral spring, 7, being interposed between the latter and the closed end of the thimble, which depends below the lower wall of the casing far enough to rest at all times upon a key of the instrument to which the apparatus is attached. The construction is such that the strikers may have free vertical movement in the thimbles without disturbing their position save when a sufficient compression of the spring 7 is effected by the downward stroke to operate the keys of the instrument upon which said thimbles rest.

Upon each striker 4 is mounted a block, 8, arranged at a point just beneath the upper wall of the casing and serving to limit the upward movement of the striker. To the forward end of this block is connected a belt or strap, 9, which is carried vertically downward a distance greater than that measured by each stroke of the bar 4, and then led around a pulley, 10, its end being attached to any suitable support above, and a sufficient slack being allowed in said belt to prevent its operative engagement with the pulley. The pulley 10 is mounted upon a shaft, 11, having bearing in the side walls of the casing. It has no rigid connection with said shaft, being loose thereon, but is clasped between two disks, 12, which are splined upon the shaft, as shown in Fig. 1, the degree of frictional contact between

the pulley and disks being rendered adjustable by suitable devices, if desired. Continuous rotation in the direction indicated by the arrow in Fig. 1 is imparted to the shaft by suitable means—as, for example, by a belt driven by a pulley on the main shaft. This portion of the mechanism has no relation to my present invention, and is so fully shown and described in my pending applications, above named, as to require no description here. A series of separate pulleys, 10, is mounted upon the shaft 11, corresponding in number and arrangement with the strikers 4, the parts of which description has been given being duplicated for each pulley and striker, respectively.

The diaphragm-chamber 2 may be conveniently constructed by inclosing it within a separate casing, 1^a, which is wholly contained within the apparatus casing 1. Within its upper and lower walls are formed air-cells 13, which increase gradually in depth from the rear toward the outer end of the casing. The whole number of these cells is equal to the number of strikers 4, and one-half thereof are placed in the lower and the remainder in the upper wall of the casing 1^a, those below being alternated with those above, so that a separate air-cell lies in substantially the same vertical plane with each of the pulleys 10. Entering the outer extremity of each cell is a duct, 14, leading toward and opening through the outer end of the casing 1^a. The ducts which lead from the upper and lower series of cells converge toward the same line drawn horizontally upon the outer end of the casing and preferably in the center thereof, or substantially so. In addition to this convergence toward a horizontal line they may also converge toward a central vertical line or point located without the casing, whereby the several external openings, 15, are not only brought into the same horizontal plane relatively to the casing, but are contained within a comparatively narrow space upon the outer end of the same, thereby enabling me to use a narrow music-sheet with small note-openings, as shown and described in one of my pending applications hereinbefore mentioned.

Covering and completely inclosing each air-cell 13, save as to its duct 14, is a flexible diaphragm, 16, formed of any suitable material, and mounted externally upon said diaphragm is a rigid diaphragm-plate, 17, glued or otherwise firmly attached thereto. This plate is preferably of somewhat less length than the air-cell, but in any event a free or unattached portion, 16^a, of the diaphragm is left to permit the expansion and collapse of the latter. At the rear end of each air-cell the diaphragm is carried over the angle of the wall of the casing and lapped down and fastened to the end thereof. The diaphragm-plate 17 extends to and rests upon the angle of the casing-wall, at which point the air-cell is without depth.

Near the outer end of each diaphragm-plate is formed an opening, 18, which extends also through the diaphragm. Upon the plate 17 and over said opening is placed a disk, 19, formed of card-board or any other suitable material, and having an aperture, 20, which is concentric, or substantially so, with the opening 18. Within the air-cell beneath is placed a pin, 21, rising through the said opening and through the aperture in the disk 19, which is of greater diameter than the pin. This pin is so mounted upon the floor of the air-cells that it may rock freely upon its head in all directions, and its point of support is somewhat removed from the circle within which the central point of the aperture 20 reciprocates as the diaphragm-plate rises and falls, whereby the pin is caused to sweep across the said apture and come in contact with opposite sides thereof at each movement of the diaphragm-plate, thereby preventing the opening from fouling or clogging with the impalpable fiber and dust constantly floating in the air. I have shown the pin as supported by a short strip, 22, through which it passes, said strip being made of any suitable material having some flexibility or elasticity, and being fastened by its end to the floor of the air-cell.

Between the two series of diaphragm-plates 17, at or near the rear ends thereof, is placed a solid block, 23, which extends from side to side of the diaphragm-chamber. The edges of this block extend nearly to the external surfaces of the opposite series of diaphragm-plates, and are beveled off to permit the unobstructed rise and fall thereof. Mounted on said block, and projecting outwardly over the diaphragm-plates, are springs 24, constructed of very light wire, and having their extremities engaging with eyes or staples 25 in the plates. By the light tension of these springs the diaphragms 16 are normally expanded, as shown in the lower-cell series in Fig. 1.

The diaphragm-chamber is closed at its rear end partly by the block 23 and in part by flexible strips 26, which pass over the ends of the diaphragm-plates 17, and are fastened upon the inner ends of the walls of the casing 1^a, said strips having sufficient flexibility to permit the unobstructed vibration of the diaphragm-plates. Upon the rear end of each of the latter is firmly mounted, by means of a screw, 27, passing through the flexible strip 26, an arm, 28, curved slightly backward or toward the pulley 10, and having upon its free extremity ears 29, between which is journaled an idle-roll, 30. The arms mounted upon the two alternating series of diaphragm-plates extend upward and downward therefrom, respectively, bringing the entire series of idle-rolls 30 into substantially the same horizontal plane and in front of the pulleys 10. The curvature of these arms and the size of the rolls is such that when the diaphragms are collapsed the idle-rolls will be withdrawn a little space from contact with the belt passing over the pulley 10, whereas, on the other hand, when the diaphragm is expanded the roll 30 will be driven against the belt 9, pressing it against

the periphery of the pulley with sufficient force to give said belt operative contact therewith. Thereupon the continuously-rotating pulley instantly throws the striker 4, to which its belt is attached, downward to the full extent of its stroke. When this point is reached, if the idle-roll still maintains its contact, the pulley 10 slips between its friction-disks 12, which continue rotation after the pulley is arrested, and the striker is held down with a continuous and substantially unvarying force as long as the idle-roll remains in contact with the belt. The two positions of the latter are clearly shown in Fig. 1.

In each of the thimbles 6, upon the lower extremities of the strikers 4, is formed a vertical slot, 6^a, which receives a pin, 7^a, projecting from the striker, whereby the thimbles are prevented from dropping out of their cells 5. One purpose accomplished by the use of these thimbles is to prevent the noise caused by the sharp contact of the strikers with the keys of the manual and to impart a certain elasticity to the stroke upon the key in imitation of the action of the human finger. Coupled with this, however, and of equal or even greater importance, is the provision of means whereby a variation in the force of the stroke may be obtained to give an expression to the rendition corresponding with the requirements of the score. The devices I have provided for this purpose are as follows: Lying against the rear vertical wall of the casing 1, and between said wall and the cell-casing containing the thimbles 6, is a flat plate, 31, to which are attached two or more vertical lifting-bars, 32, which pass through and project above the upper wall of the casing. Upon the top of the casing are fulcrumed levers 33, having their ends connected with said lifting-bars, and between the ends of each lever and bearing upon its under surface is placed a cam, 34, mounted upon a shaft, 35, which is journaled in suitable bearings on the casing and provided with a key, 36. The blocks 8, mounted upon the strikers 4, are projected rearward far enough to bring them over the edge of the plate 31, for the purpose of arresting the downward movement of the strikers when the blocks strike the plate. By raising the latter by the adjustment of the cams 34, the strikers may be arrested at any desired point within the limits of the given adjustment, and, as the force of the stroke imparted by the springs 7 to the keys of the instrument is correspondingly diminished, a soft note will be produced, and vice versa.

The plate 31 may extend from end to end of the series of strikers; but I prefer to construct and mount it in separate sections, as shown in Fig. 2, of two or three in number, each having a separate adjustment. By this means a variety of expression may be considerably increased.

The operation of the remaining portions of the mechanism requires no especial explanation. The music-paper, perforated in the usual manner, is drawn over the rounded outer end of the casing, the longitudinal lines of note-openings registering with the open ends of the air-ducts. The air is exhausted from the diaphragm-chamber 2 by a pipe, 2^a, connected with the organ-bellows, or with a separate bellows. By this exhaust the diaphragms are collapsed and the idle-rolls withdrawn from the belts of the actuating-pulleys 10, the exhaust from the air-cells being through the openings in the diaphragm-plates. As the note-openings in the music-sheet reach the mouths 15 of the air-ducts, air rushes into the corresponding cells, the diaphragms thereof expand, and the rolls 30 effect an operative engagement between the belts 9 and pulleys 10, depressing the strikers 4 and holding them down and keeping the notes open as long as the note-openings are traveling over the entrances to the air-ducts.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a key-board player, the combination, with a series of strikers arranged above the keys of the manual, of thimbles loosely mounted thereon and resting upon said keys, and springs interposed between said thimbles and the ends of the strikers, substantially as specified.

2. In a key-board player, the combination, with a series of thimbles resting upon the keys of the manual, of springs contained within said thimbles, strikers resting upon said springs, and mechanism for imparting movement to the strikers, substantially as specified.

3. In a key-board player, the combination, with a series of strikers arranged over the keys of the manual, of mechanism, substantially as described, for depressing said strikers at intervals, and a vertically-adjustable stop limiting the downward movement of said strikers, substantially as specified.

4. In a key-board player, the combination, with a series of spring-holders resting upon the keys of the manual, of strikers arranged above the springs therein, and one or more stops having vertical adjustment for limiting the downward movement of the strikers, substantially as specified.

5. In a key-board player, the combination, with a series of strikers arranged above the keys of the manual, of springs interposed between said keys and strikers, one or more vertically-adjustable stop-plates limiting the downward movement of said strikers, levers connected with said plate or plates, and cams by which said levers are actuated, substantially as specified.

6 In a key-board player, the combination, with two alternating series of air-cells, of flexible diaphragms covering said cells, rigid plates mounted upon the diaphragms, arms attached to the ends of said plates and carrying idle-rolls, and pulleys having continuous rotation within loose belts, substantially as specified.

7. In a key-board player, the combination,

with a series of air-cells, flexible diaphragms covering the same, and rigid plates mounted on said diaphragms and having openings leading to the cells, of perforated disks mounted upon the plates over the openings, and pins attached to and rocking upon the cell-floors and passing through the openings in the plates and disks, substantially as specified.

8. In a key-board player, the combination, with a diaphragm-chamber having air-cells upon the opposite sides thereof and alternately arranged, of diaphragms covering said cells, rigid plates mounted on said diaphragms and having openings communicating with the cells, arms mounted on the ends of said plates, idle-rolls carried by said arms, continuously-revolving pulleys carried by friction-disks, loose belts attached to the strikers, means for exhausting the diaphragm-chamber, and a perforated music-sheet fed over air-ducts communicating with the air-cells, substantially as specified.

9. In a key-board player, the combination, with a series of vertical strikers, of springs interposed between their ends and the keys of the manual, blocks mounted on said strikers and connected with belts loosely carried around continuously-revolving pulleys, idle-rolls mounted upon plates carried by flexible diaphragms covering air-cells, rocking pins carried in bearings on the floors of said cells and rising through openings in the diaphragms and plates, disks mounted over said openings and having apertures for the pins, means for exhausting said cells, and a music-sheet fed over air-ducts communicating with the latter, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

ROSWELL T. SMITH.

Witnesses:
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