

G. H. DAVIS.
ELECTRIC SELF PLAYING PIANO ATTACHMENT.

APPLICATION FILED DEC. 23, 1898.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

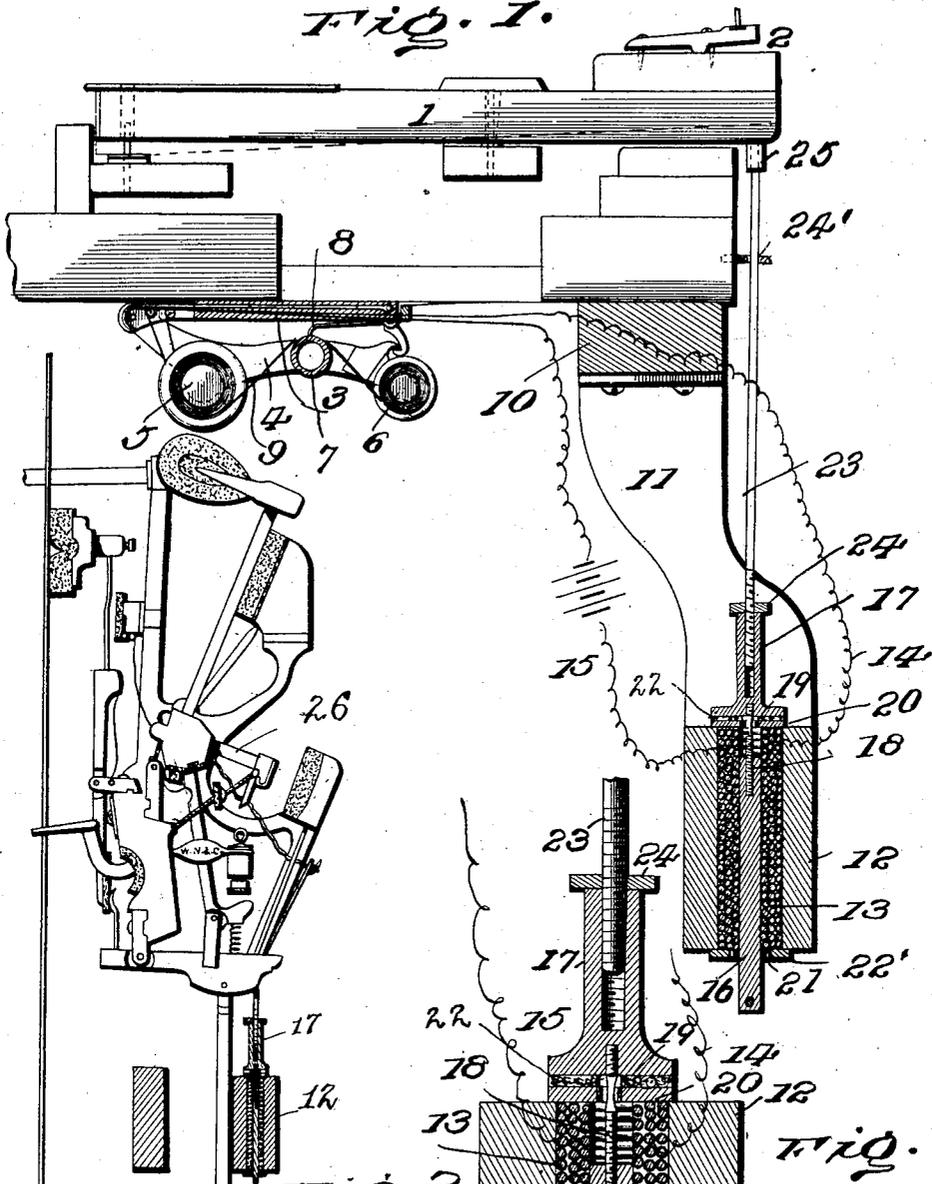


Fig. 3.

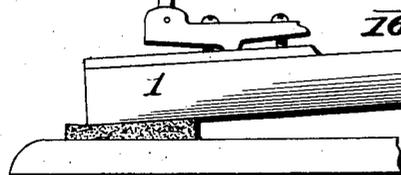
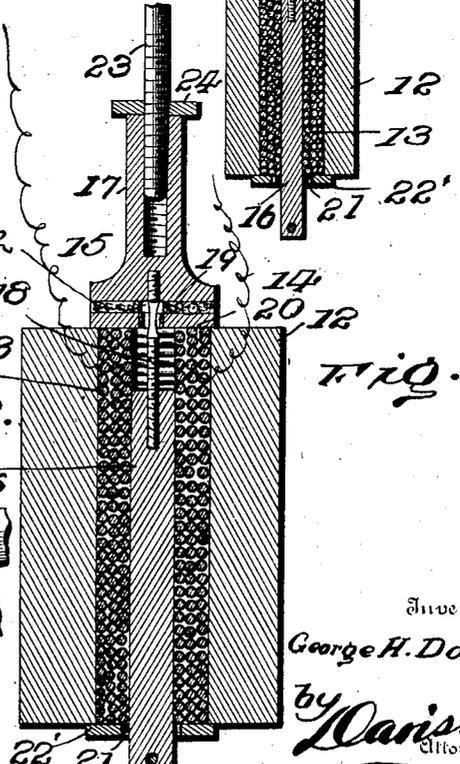


Fig. 2.



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ELECTRIC SELF-PLAYING PIANO ATTACHMENT.

SPECIFICATION forming part of Letters Patent No. 730,098, dated June 2, 1903.

Application filed December 23, 1898. Serial No. 700,159. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HOWLETT DAVIS, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new, useful, and valuable Improvement in Electric Self-Playing Piano Attachments, of which the following is a full, clear, and exact description.

My present invention relates to certain new and useful improvements in electrical self-playing pianos; and it is the prime object of the invention to greatly simplify the general construction of instruments of this character and reduce the number of operating parts, so that the cost of manufacture and liability get out of order will also be reduced.

It is the purpose of this invention to operate the keys or the sound-producing devices of a musical instrument through the medium of a plurality of solenoid-magnets having direct connection with said keys or sound-producing devices, so as to obviate the employment of a rotary drum, electromagnets, and friction-shoes, all of which have heretofore been largely used in self-playing instruments.

In order to enable others skilled in the art to understand, make, and use my said improvements, I will proceed to describe the same in detail and then follow said description with a series of claims definitely pointing out what I consider to be new and what I desire to cover by these Letters Patent.

In the accompanying drawings, forming part of this specification, Figure 1 is a transverse sectional view of a piano-keyboard with my improvement applied to the under side thereof. Fig. 2 is an enlarged detail sectional view of my solenoid-magnet, which forms the leading feature of this invention, together with the preferred form of striker-rod. Fig. 3 is a modified arrangement of my invention, showing the operating mechanism acting directly upon the sound-producing devices. Fig. 4 is a rear view showing the manner in which the solenoids are arranged and mounted.

Entering into a detailed description of the several parts and their *modus operandi*, like numerals hereinafter employed refer to like parts in the several views of the drawings.

The piano-key 1 and the supporting-key-

board or frame 2 are of the usual construction. The music-sheet holder, composed of the base 3, swinging frame 4, take-up roller 5, delivery-roller 6, contact-roller 7, contact-finger 8, and the perforated music-sheet 9, which latter serves to make and break the electric circuits between the said contact-roller and contact-fingers, are all of the form shown in my Patent No. 546,582, dated September 17, 1895; but it must be understood that my solenoid-magnets, to be hereinafter more fully described, may be used in connection with or be controlled by any operative form of circuit making and breaking device.

In this instance I suspend my new action from a base-block 10, secured to the under side of the keyboard 2. The brackets 11, secured rigidly to the base-block 10, secure and hold in rigid position the cross-beam 12. In said cross-beam are bored a series of round holes, and into each of these holes is inserted a helix of wire 13; having the terminals 14 and 15, leading to the contact device. Within said helix is movably supported an iron core 16, which is rigidly connected to the wood connector 17 by means of the brass rod 18 sliding through the felt bushing 19 in the cap 20. The core 16 also bears at its lower end in the bushed hole 21 of cap 22'. Interposed between the bottom of the connector 17 and upper cap 20 is a heavy felt disk 22. Into the top of said connector 17 is secured the lower end of striker-rod 23, having the lock-nut 24 thereon. Near the top of said striker-rod 23 is a guide 24', through which the striker-rod slides, and at the extreme top of said rod 23 is provided a wood cap 25, having a felted top or face next the under surface of the piano-key. The connector 17, rod 18, striker-rod 23, and cap 25, with their appurtenant parts, may be said to form an extension of the core 16, said parts all moving in unison therewith. Now whenever the circuit is completed through the helix 13, forming with the core 16 a solenoid-magnet, then the core rises under the known laws applicable to this special form of magnet, and the connector 17 and striker-rod 23 also rise therewith and cause the top end of the latter or button 25 to impinge the key 1, which in turn also rises and causes the superin-

duced piano-action (not shown) to be thrown into action, causing the hammer to strike the strings with a force depending upon the strength of the current allowed to pass through the helix.

As above described, the helix of the solenoid is seated in a pocket formed in the cross-beam 12 in vertical alinement with the part of the key of the sound-producing devices against which the rod 23 operates. There is an especial reason for this form of seating in that the parts are held accurately positioned in relation to each other. Owing to the fact that the core of the solenoid moves vertically and is adjustably connected with the connector 17 should no support be provided which would hold the opposite ends of the helix against lateral movement there would be a tendency for the upper end of the helix to become displaced from its position laterally. This is due to the fact that the upward movement of the core is positive and to a fixed position, and hence any inaccuracy of adjustment or other cause might tend to attempt to limit this upward movement, with the result that some portion of the actuating mechanism would necessarily give, probably in connection with the connector or the rod 18, which would then tend to force the core to a false direction of movement. This in turn would cause the upper end of the helix to be moved laterally and out of its proper position to operate smoothly with the core. Any such tendency is prevented by holding the opposite ends of the helix against displacement, whether by the use of a pocket which wholly incloses the vertical length of the helix or which simply incloses the opposite ends, and the use of a continuous support in this connection adds to the value, for the reason that such displacement is prevented in each solenoid relatively to each other, such as might occur in the use of separate pockets secured to a base, as in the latter case the point of weakness would be in the securing means between the pocket-support and its base.

As shown and described, the core 16 is adjustably secured to the connector, and the latter is adjustably secured to the rod 23. This construction is of positive advantage in an operating device of this character. As before stated, the core moves from an adjusted position to one which is fixed regardless of its length of movement, this movement being due to the current passing through the helix. The return movement of the core and the parts carried by it is due solely to the weight of the core, the cap 20 forming the stop against downward movement. The upward movement of the core being due solely to the energizing of the helix will depend for its rapidity of movement on the strength of the current passing through the helix, a strong current causing a more rapid movement than a weak current, and on the distance which the core travels. Instead of attempting to control this rapidity by varying the strength

of the battery used I adjust the position of the core relatively to the helix so that a greater or less movement of the core in the helix, according to the distance between the top of the core and the upper end of the helix, will control the rapidity of movement of the core in the direction to sound the device. The adjustment therefore serves to vary the rapidity of movement. This control of the rapidity serves two purposes—first, to change the “action” of a piano, and, second, to govern the stroke of the hammer, the latter being harder as the core moves with greater rapidity. The controlling of the action is important, inasmuch as different makes of pianos and oftentimes different pianos of the same make have their actions operate to require a touch which may vary from a weak to a strong touch, and there is also a variation in the length of the rocking movement of the keys. Where the touch is weak, there is less requirement of rapid movement of the core than where a strong touch is required, so that this adjustment forms a particular part in controlling the movement of the action, and where the upward action is more rapid there is a quicker response to the action of the make-and-break device, enabling the playing of music where rapidity is an especial feature, thus making a construction which is more or less sensitive as the uses to which it is put require. The return movement of the core is not due to the movement of the key, but to the weight of the core, together with the parts carried thereby, thus forming a positive-acting device which will instantly return the core to its initial position as soon as the circuit is broken.

It is understood, of course, that when the distance between the top of the core and the cap 20 is changed the rod 23 must also be adjusted so that the key 2 will have no greater movement. In such case, especially where the movement of the core is considerable, the button 25 will normally be out of contact with the bottom of the key.

The principal advantage of this construction is its extreme simplicity, rendering it economical to manufacture, and having only one movable part it is unlikely to ever get out of order.

Instead of attacking the key of a piano it is obvious that my improvement may be arranged to attack the sound-producing devices 26 direct, as shown in Fig. 3.

What I claim is—

1. In an electrical self-playing musical instrument the combination with the sound-actuating devices; of a plurality of solenoids, a cross-beam provided with means for supporting and embracing the coils of said solenoids throughout their length, a weighted iron core movable in each solenoid, the action of the solenoid moving said core in opposition to the weight of the core, means attached to each core for operating the sound-actuating devices, said means supporting the core, and

contact making and breaking devices in circuit with the solenoids.

2. In an electric self-playing piano, the combination with the keys thereof, of a cross-beam mounted below said keys and provided with a plurality of pockets, a solenoid supported in each pocket in the beam and held against lateral movement therein, an extension on the core-piece of each solenoid arranged to engage with one of the said piano-keys to actuate the latter, a source of electric energy in circuit with the solenoids, and contact making and breaking devices.

3. In an electrical self-playing musical instrument the combination with the sound-producing devices, of a cross-beam located below said devices, said beam having a plurality of vertical openings extending there-through arranged in longitudinal alinement, a solenoid in each of said openings, said solenoids being held against movement in said openings, a core movable in each solenoid, a contact making and breaking device for each solenoid, and means carried by the core and extending in alinement with the axis of the core for actuating the sound-producing devices during the movement of the core upwardly by the action of the solenoid, said core and means being free to move in the opposite direction independent of the sound-producing devices.

4. In an electrical self-playing musical instrument, the combination with the sound-producing devices, of a cross-beam provided with a plurality of pockets, a wire helix in each pocket, an iron core movable in each helix, a connector attached to the upper end of each core, a rod adjustably connected to each connector at one end and having its opposite end arranged to actuate the sound-producing devices, a felt disk or cushion below each connector, and contact making and breaking devices in circuit with the helices.

5. In an electrical self-playing musical instrument the combination with the sound-producing devices, of a solenoid for each device, a weighted core movable vertically within each solenoid, the action of the solenoid moving the core in opposition to the weight thereof, a contact making and breaking device, and means carried by the core and extending in alinement with the axis of the core for actuating the sound-producing devices during the movement of the core upwardly by the action of the solenoid, said core and means being free to move in the opposite direction independent of the sound-producing devices under the action of the core and the actuating means carried thereby.

6. In an electrical self-playing musical instrument, the combination with the sound-producing devices; of a solenoid for each device, having its core-piece extending in a ver-

tical direction; means for normally holding said core-piece suspended; an actuating-rod extending vertically from and in alinement with the axis of said core-piece to impart a movement to the device in one direction; and an electric make-and-break device for intermittently energizing said solenoid, whereby said core-piece will be positively moved to actuate the device by electrical action, said rod and core-piece being free to move in the opposite direction independent of the sound-producing devices.

7. The combination with sound-producing devices; of a solenoid for each device, having its core extending vertically; a connector forming the sole support for the core when in inoperative position; a rod carried by said connector and supported thereby for actuating the devices; and energizing means for said solenoid, said means moving the core in opposition to the weight thereof.

8. The combination with sound-producing devices; of a solenoid for each device, having its core extending vertically; a connector normally resting on the helix of the solenoid and insulated therefrom, said connector by means normally located on the helix of the solenoid forming the sole support for the core when in inoperative position; a rod carried by said connector for actuating the devices; and energizing means for said solenoid, the return movement being independent of the movement of the sound-producing devices.

9. The combination with sound-producing devices; of a solenoid for each device, having its core extending vertically; a connector adjustably connected to said core and forming the sole support therefor when in inoperative position; a rod for actuating said device, adjustably secured to said connector and supported thereby, whereby the length of movement of the core may be varied without varying the length of movement of the device; and energizing means for said solenoid, said means moving the core in opposition to the weight thereof.

10. The combination with the sound-producing devices; of a solenoid for each device, each solenoid having its core adjustably suspended within its helix, said core having adjustable means for moving its device in one direction, the adjustment of said core serving to regulate the rapidity of movement of the core within its helix; a source of electrical energy in circuit with the helices; and a make-and-break device for each helix.

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

GEORGE HOWLETT DAVIS.

Witnesses:

EDWIN FRENCH, Jr.,
JOHN T. SACKS.