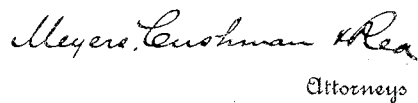


Patented Sept. 3, 1912.



UNITED STATES PATENT OFFICE.

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ELECTRIC PIANO.

1,037,349.

Specification of Letters Patent.

Patented Sept. 3, 1912.

Application filed February 12, 1906. Serial No. 301,903.

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 Electric Pianos, of which the following is a specification.

My invention relates to electric pianos, and has for its object to provide such an instrument having new combinations, arrangements and mode of operation of elements to accomplish the certain and accurate automatic actuation of the hammers, and also the operation of the dampers.

To the end stated the invention consists in the parts and features, and in the combination, arrangement and mode of operation of parts hereinafter set forth.

That which is regarded as new will be stated in the clauses of claim appended to the description.

In the accompanying drawings illustrating that which I regard as the best known embodiment of the invention, the figure is a side elevation.

In said drawings the reference numeral 1 designates the casing of the instrument within which the mechanism is located, and which, because the usual key-base and manual keys are dispensed with, may be of rectangular form, economical of manufacture, and of minimum space-occupying capacity.

I have shown but one of the hammers, dampers, magnets and other elements referred to, as exemplary of the series of such devices. To do more would not make any clearer an understanding of my invention.

Within the casing are disposed a sound-board 2, string-plate 3 and strings 4, which elements may be of any known suitable type and arrangement.

5 indicates a shaft on which a series of hammers 6 appropriated to the several strings 4, are arranged to oscillate, normally resting against a felted rest-rail 7, and adapted to be caused to oscillate and strike the strings. The rest-rail 7 may be movable and controlled to variously position the hammers with respect to the strings to secure variety of expression, as disclosed in connection with the expression bar shown in

my Letters Patent No. 782,799 dated February 14, 1905.

The hammers are actuated by electro-magnets 8, and appropriate connections the operation of which is controlled by a controller hereinafter referred to. The magnets shown are of horse-shoe type and are carried in suitable supports 9; and the armatures 10 thereof are carried on a series of levers 11 mounted on the shaft 5 and arranged to engage and oscillate the hammers. The engagement between levers 11 and hammers 6 is through the medium of abutment-pins 12, 12^a at the butts 13 of the hammers and between which the levers freely play with lost-motion for a purpose which will appear. Cooperating with the hammers are a corresponding series of felted dampers 14, serving the usual purpose of such devices. They are carried by rockers 15 arranged to rock on a shaft 16, and associated therewith are means, shown as springs 17, secured to a rail 18 and bearing against the rockers, as by engagement with pins 19, acting thereon to maintain the dampers normally against the strings. Operatively situated with relation to the rocker 15 are electro-magnets 20 preferably of the iron-clad type the casings of which are provided with insulated contacts 30 and 32, hereinafter referred to. The armatures 21 of magnets 20 are carried by the rockers, and the office thereof is to hold the dampers away from the strings for periods determined by the controller devices to secure notes of different time value, as sixteenth, eighth, quarter, half or whole notes. In the preferred organization shown the rockers are operated to withdraw the dampers in advance of the striking of the strings by the hammers, by means receiving operation from the hammer-actuating means. This is accomplished by arranging some of the rockers in the path of extensions 22 of the levers 11; whereby when said levers are operated to actuate the hammers as described the rockers are first rocked, withdrawing the dampers from the strings and bringing the armatures 21 to rest against the magnets 20 where they are held as long as the magnets are energized. Afterward the parts are restored to normal position by the springs 17. One purpose of the lost-motion connec-

tion between the levers 11 and the hammers is now apparent in that it permits, with certainty, that the dampers shall be withdrawn from the strings before the impact of the hammer.

The operations of the hammer-actuating magnets 8 and the magnet 20, are regulated by a controller common to both, and one suitable organization by which this is effected is shown; and therein the reference numeral 23 designates a contact, preferably a roller common to the several selective contacts (next to be referred to) and electrically connected as at 24 to one end of a source of electricity, a battery 25 being shown for example. Arranged to contact with 23, being suitably carried in and insulated from a support 26, are a series of contact fingers 27, severally connected to the windings of the several hammer-actuating magnets, the circuit being from contact finger 27 by wire 28, through magnet winding, by wire 29 to contact 32, through bridge 31 (on rocker 15) contact 30, and wire 33 to battery 25. The magnets 20 are included in shunts of the described hammer magnet circuits, and the circuit of these magnets is from battery 25, by wire 24 to contact 23, to contact finger 27, wire 28, through shunt 34, winding of magnet 20, and wire 33 to battery 25.

The controller shown is a perforated music sheet 37 having therein perforations representing musical notes of different scale and time value, such as is well known and therefore, not necessary to be illustrated.

35 and 36 designate the usual music sheet feed and take-up rolls. This sheet serves as a circuit-maker for the hammer-actuating and damper-operating magnets, and as circuit-breaker for the circuits of the damper-operating magnets. It will be observed, accordingly, that the circuits of the damper-operating magnets are maintained or sustained a greater or lesser period according to the period of contact of 27 with 23, and this is governed by the length of the note perforations in the sheet 37. The effect is to hold the damper away from the strings an interval corresponding to the time value of the several passing note perforations, to secure tones of different time value. The hammer-actuating magnet-circuits, on the contrary, remain closed for but a moment to impart a quick, uniform, momentary impact of the hammers against the strings. This operation is accomplished by breaking the circuits of these magnets during the stroke of the hammers, permitting the armatures 10 to fall away from the poles of magnets 8 slightly preceding the impact of the hammers upon the strings, and permitting the hammers to rebound from the strings instantly. This is accomplished by the action of the extensions 22 of levers 11 rocking the rockers 15 and withdrawing the

bridges 31 from contacts 30 and 32. The lost-motion connection between levers 11 and the hammers, permits the former to drop, with the armatures 8, immediately the circuits of the hammer-actuating magnets are broken, to get out of the way of the hammers and not interfere with or impede the rebound thereof. In their continued fall the levers engage the abutments 12^a and restore the hammers to normal position against the rest-rail 7.

It will be observed by the foregoing description that the main current for energizing the hammer actuating magnets is but a momentary one whereby quick action of the hammer is obtained, enabling a rapid repetition to be accomplished; and, furthermore, with the use of a minimum consumption of current, making a primary battery a possible source of power. The current which controls the damper magnets on the other hand may be maintained as long as desired, depending upon the length of the note perforations in the controller sheet.

Having thus disclosed my invention, what I claim is:

1. In a device of the class described, a musical string, a hammer in operative relation thereto, a magnet armature directly connected, through a lost-motion device with said hammer, and an electromagnet associated with the armature.

2. In a device of the class described, a musical string, a hammer adjacent thereto, an electromagnet, and an armature associated therewith, connected with the hammer, for operation thereof by direct magnetic pull, and movable between certain limits independent of such hammer.

3. In a device of the class described, a musical string, a hammer adjacent thereto, an electromagnet, an armature therefor, combined with the hammer, and means connecting said armature and hammer, during the latter part only of the movement of the former.

4. In a device of the class described, a musical string, a hammer disposed in operative relation thereto, and provided with abutments, an electro-magnet, and an armature under the influence of the magnet for moving the hammer, the said armature being capable of movements relative to the hammer which are limited by said abutments.

5. In a device of the class described, a musical string, a hammer pivoted adjacent thereto, an electromagnet for operating the hammer, an armature under the influence thereof, an oscillatory lever carrying the armature, and abutments on the hammer between which the said lever oscillates.

6. In a device of the class described, a musical string, a pivoted hammer adjacent thereto, an electromagnet, an armature

therefor, a pivoted lever to which said armature is attached, a pair of spaced abutments carried by said hammer and disposed, one at each side of said lever, whereby the lever serves to move the hammer when in contact with either abutment.

7. In combination, a sound-producing device, a hammer associated therewith, an electro-magnet in coöperative relation with said hammer, a damper, a second electro-magnet governing the operation of said damper, and means connected with said damper for controlling the circuit of the first named electro-magnet.

8. In combination, a musical string, a hammer, a damper, a single electro-magnetic means connected with the hammer for both actuating the same and withdrawing the damper from said string, and additional electro-magnetic means rendered operative by the movement of the damper for holding said damper in its withdrawn position.

9. In automatic, electrical, stringed musical instruments, the combination with a hammer, of an electro-magnet having an armature arranged to positively actuate the hammer, a rocker mounted independently of said hammer also actuated by said armature, a damper and an armature carried by said rocker, a second electro-magnet acting on said armature to govern said damper, and a circuit-controller for said electro-magnets.

10. In a device of the class described, a musical string, a hammer coöperating therewith, an electro-magnet for operating said hammer, a damper, a second electro-magnet governing the operation of said damper, and means connected with said damper for controlling the circuit of the first named electro-magnet.

11. In a device of the character described, musical strings, hammers, electro-magnets for individually and positively actuating the same, individual dampers, means operated by said magnets for withdrawing the dampers from the strings, and individual means in addition to said magnets for holding said dampers withdrawn during a predetermined interval.

12. An automatic electrical stringed musical instrument comprising a plurality of strings, hammers adjacent thereto, individual dampers associated therewith, electro-magnetic means for positively actuating said hammers and dampers, a circuit-controller for said electro-magnetic means, and individual additional electro-magnetic means governed by said controller for holding any one of said dampers withdrawn from its string during a predetermined time after the respective hammer stroke.

13. In automatic electrical stringed instruments, a plurality of strings, a plurality of hammers for operating thereon, indi-

vidual dampers for the strings, electro-magnetic means for imparting motion to the hammers and for withdrawing the dampers individually, and individual means for holding each damper withdrawn while the corresponding hammer returns to its normal position.

14. An automatic electrical musical instrument having strings, in combination with a hammer, an electro-magnet, an armature therefor associated with the hammer, said electro-magnet and armature being arranged to positively actuate the hammer by direct magnetic pull, a damper, means operated by said armature for withdrawing the damper from a string of the instrument, a second electro-magnet, an armature therefor, rigidly connected with the damper for holding the same withdrawn, and means for determining the time interval during which the damper is held withdrawn.

15. An automatic electrical musical instrument, comprising strings, hammers, individual dampers, electro-magnetic means combined with each hammer for directly actuating the same by magnetic pull and simultaneously withdrawing the corresponding damper from a string of the instrument, individual additional electro-magnetic means for positively holding each damper withdrawn from its string, and a controller having means for determining the interval during which the damper is held withdrawn.

16. An automatic electrical musical instrument comprising strings, in combination with a hammer, a damper, and electro-magnetic means for directly operating the hammer by magnetic pull said means acting to cause a momentary impact of the hammer with a string, and to withdraw the damper, independent individual means for holding the damper withdrawn, said means being operative only after movement of the damper and a controller for determining automatically the interval during which the damper is withheld from the string.

17. In combination, a plurality of sound producing devices, a hammer and damper in coöperative relation with each, means for selectively operating said hammers and withdrawing the corresponding dampers, and individual means for automatically holding any damper in its withdrawn position during a predetermined interval.

18. In combination, a plurality of sound producing devices, a hammer and an individual damper coöperatively associated with each sound producing device, means for automatically operating said hammers and dampers, and means for automatically individually holding certain of said dampers in their operated position while the corresponding hammers return to normal position.

19. An automatic musical instrument com-

prising sound-producing elements, hammers
for operating the said elements, electro-
magnets arranged to actuate said hammers,
armatures for said electro-magnets secured
5 to said hammers, dampers separate from the
hammers, means associated with said ham-
mers for withdrawing the dampers from
the sound-producing elements, electro-mag-
nets arranged to hold the dampers with-
10 drawn for a limited period of time, and
armatures for said electro-magnets associ-
ated with the dampers.

20. An automatic musical instrument com-
prising sound-producing elements, hammers
15 for operating the said elements, electro-
magnets arranged to actuate said hammers,
armatures for said electro-magnets secured
to said hammers, dampers separate from the
hammers, means associated with said ham-
mers for withdrawing the dampers from the
20 sound producing elements, electro-magnets
arranged to hold the dampers withdrawn
for a limited period of time, armatures for

said electro-magnets associated with the
dampers, and a controller by which the time
25 said dampers are held withdrawn is deter-
mined.

21. An automatic musical instrument com-
prising sound-producing elements, electro-
magnetically operated hammers for operat- 30
ing said elements, dampers separate from
said hammers, electro-magnets associated
with said dampers which operate to hold
said dampers in withdrawn positions, means
associated with the hammers whereby said 35
dampers are withdrawn when the hammers
are actuated, and means for determining
the time which said electro-magnets will
hold said dampers in withdrawn positions.

In testimony whereof I have hereunto set 40
my hand in presence of two subscribing wit-
nesses.

IRVING B. SMITH.

Witnesses:

F. W. ECKELMEYER,
W. B. MARSHALL.