

No. 824,315.

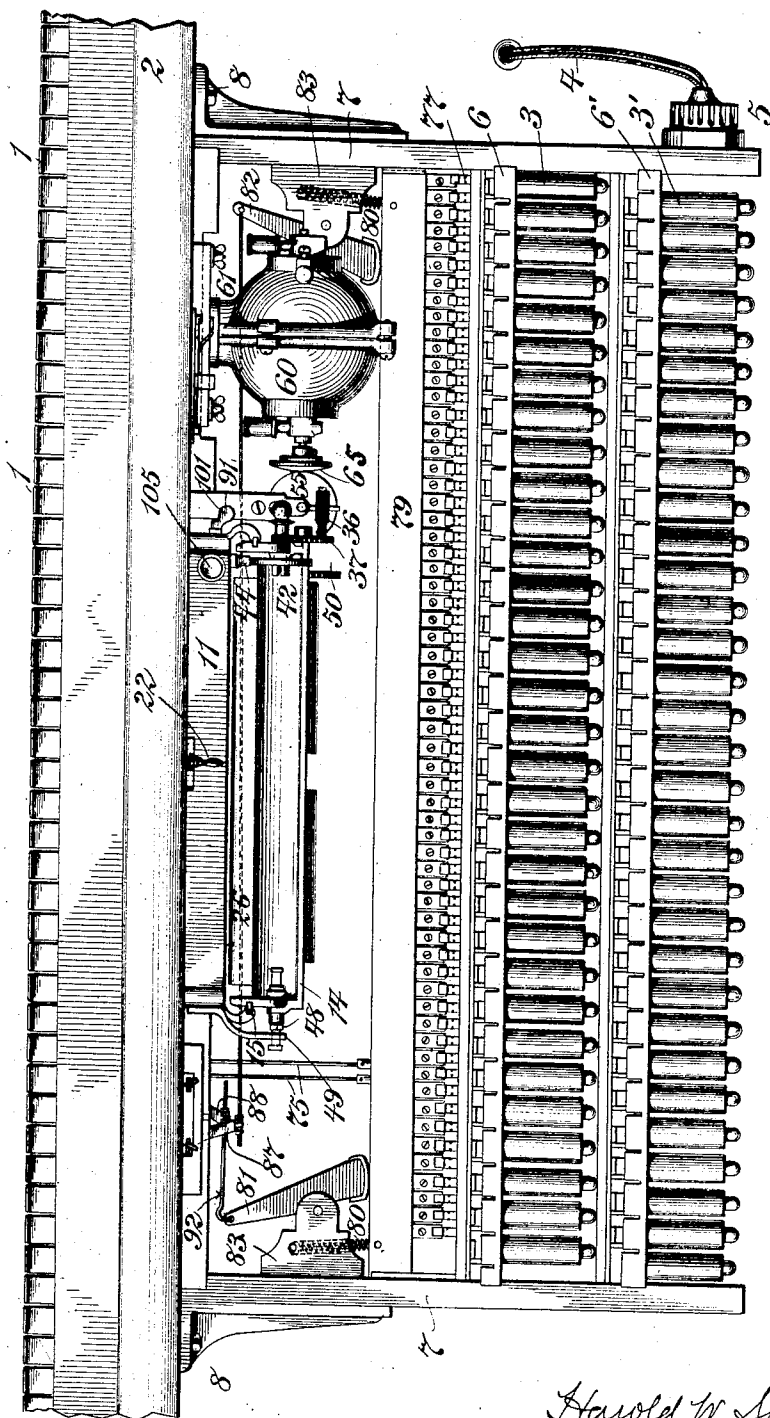
PATENTED JUNE 26, 1906.

H. W. SHONNARD.
SELF PLAYING MUSICAL INSTRUMENT.

APPLICATION FILED MAY 2, 1902.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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Walter Scott.

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By his Attorney H. MacKaye

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5 SHEETS—SHEET 2.

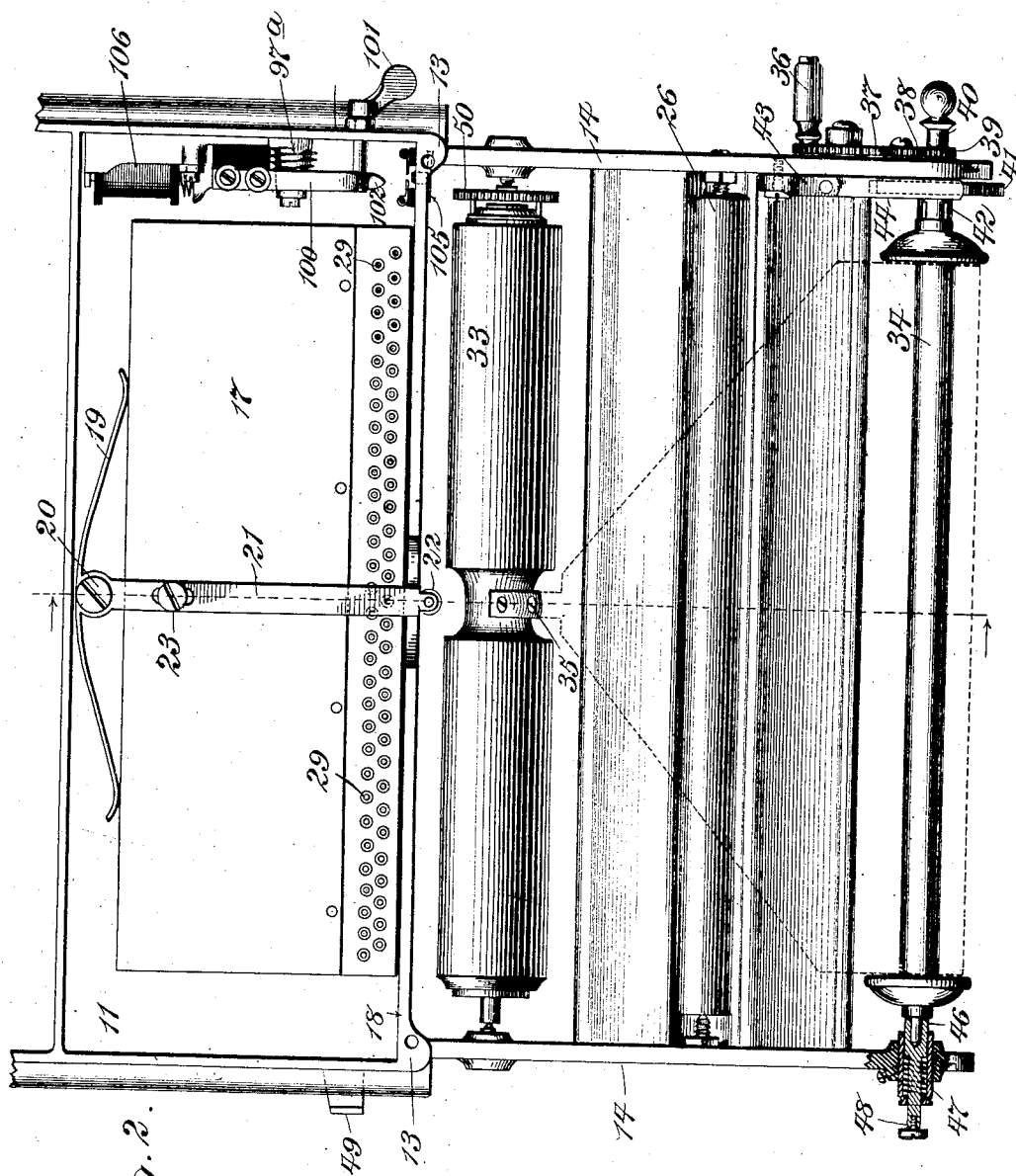


Fig. 2.

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5 SHEETS—SHEET 3.

Fig. 3.

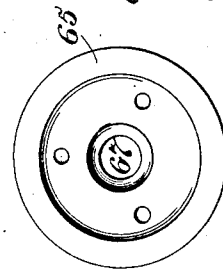
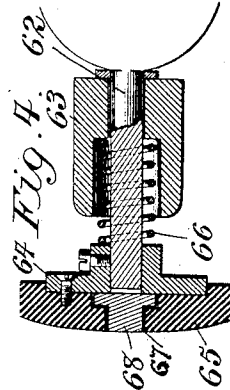
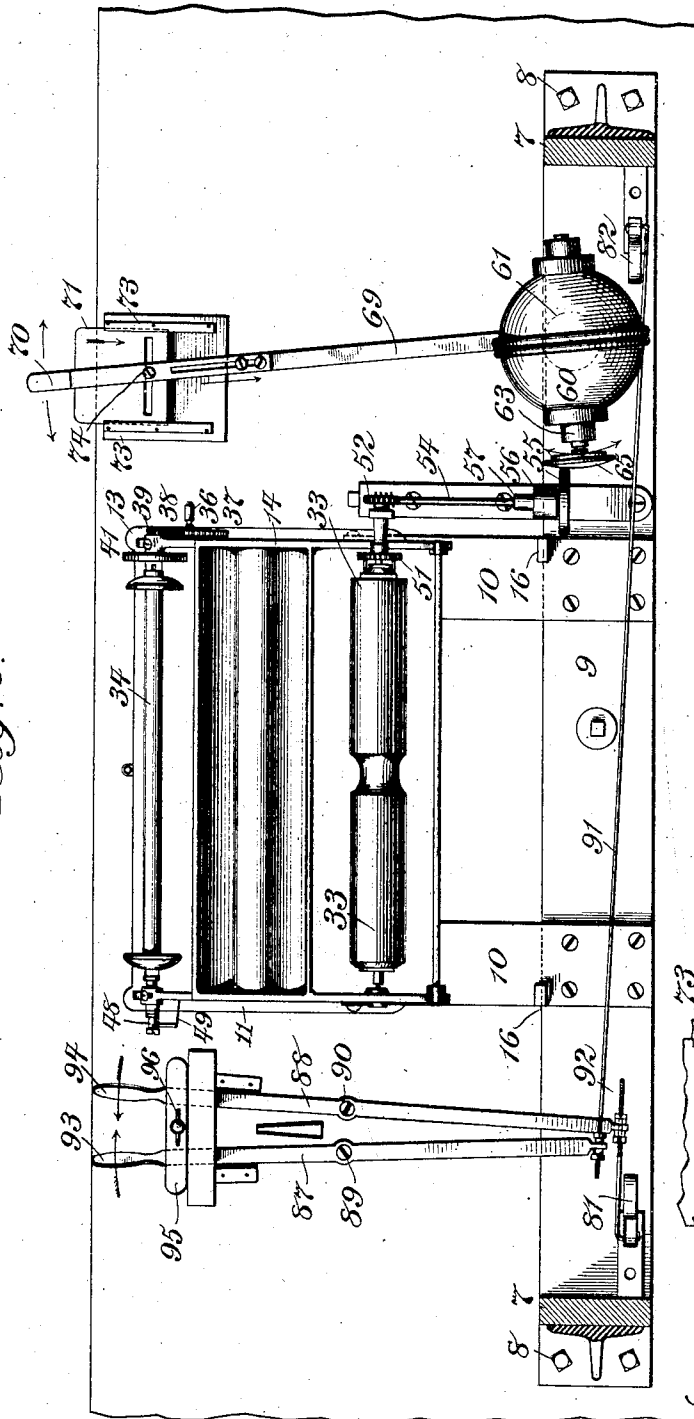


Fig. 5.

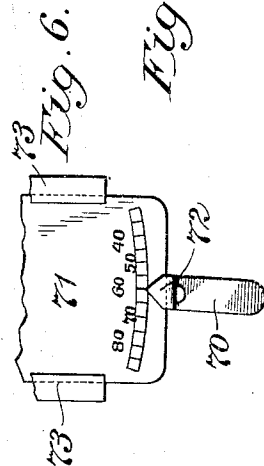


Fig. 6.

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5 SHEETS—SHEET 4.

Fig. 8.

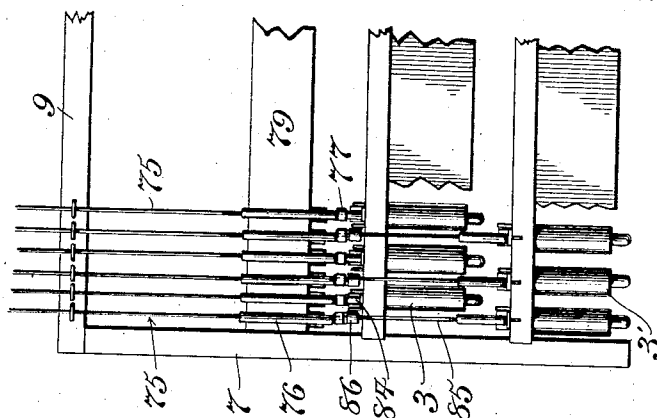


Fig. 7.

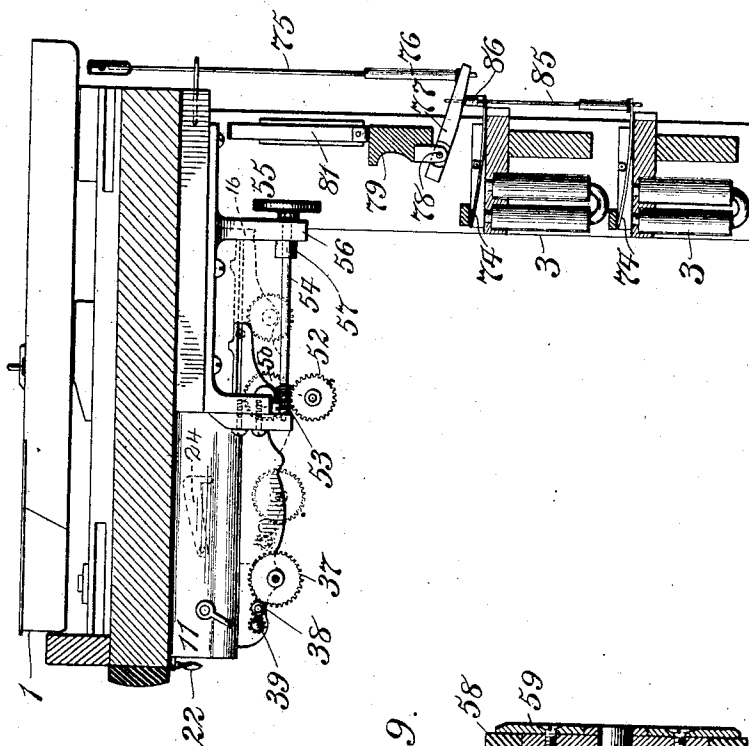
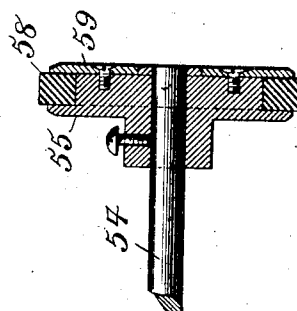


Fig. 9.



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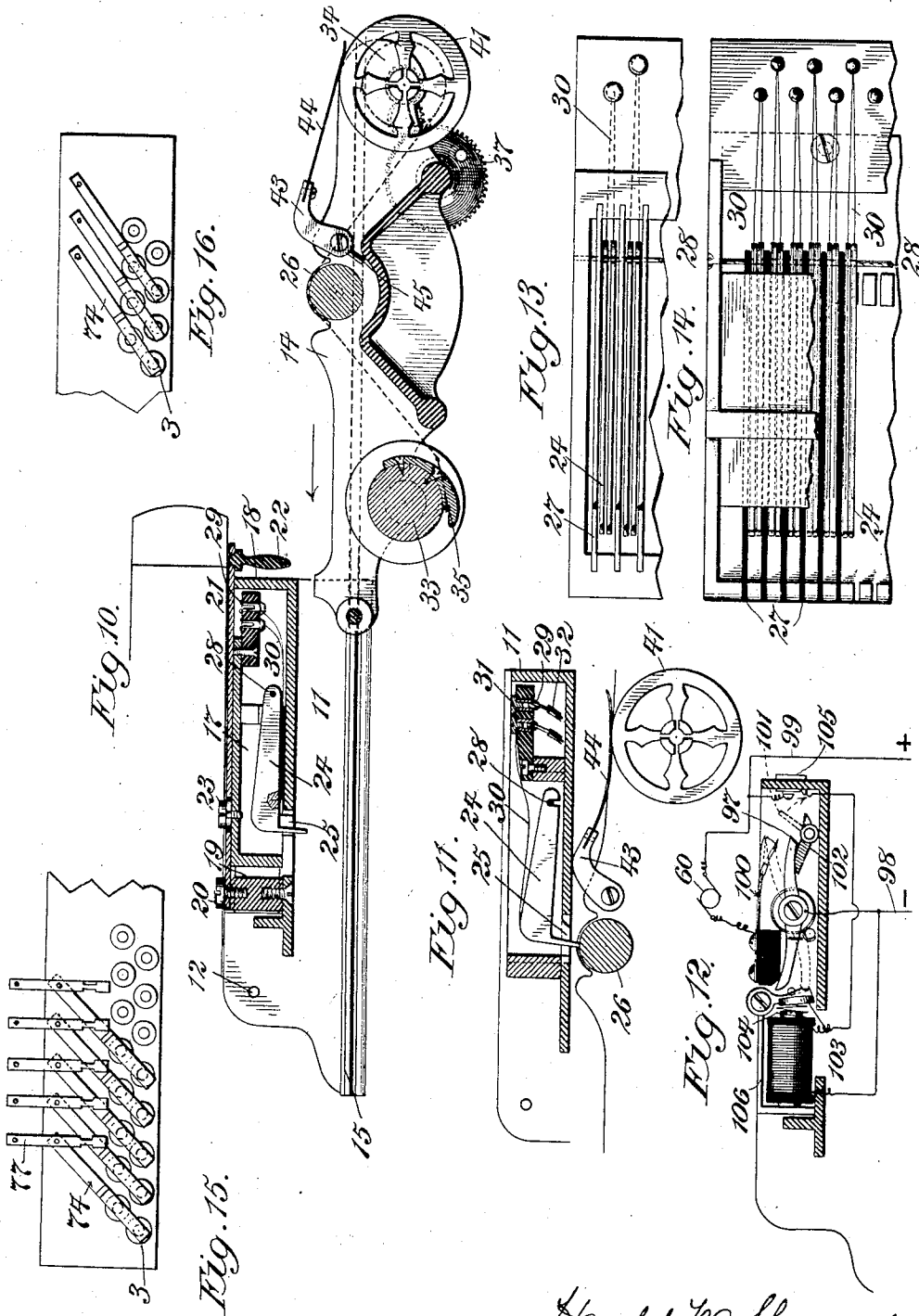
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APPLICATION FILED MAY 2, 1902.

5 SHEETS—SHEET 5.



Witnesses
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UNITED STATES PATENT OFFICE.

HAROLD W. SHONNARD, OF NEW YORK, N. Y.

SELF-PLAYING MUSICAL INSTRUMENT.

No. 824,315.

Specification of Letters Patent.

Patented June 26, 1906.

Application filed May 2, 1902. Serial No. 105,598.

To all whom it may concern:

Be it known that I, HAROLD W. SHONNARD, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Self-Playing Musical Instruments, of which the following is a specification.

My invention has relation to self-playing musical instruments, and more particularly to electrically-operated attachments for pianos.

The principal objects of my invention are as follows:

15 The provision of means whereby the volume of tone produced can be instantly controlled by the performer over a wide range and preferably in different parts of the keyboard at will.

20 The provision of improved means for instantaneously controlling the tempo at will without interference with other elements of musical expression and without impairing certainty of action in any case.

25 The provision of means whereby accidental variations in position of the perforated music-sheet may be quickly and easily compensated for. The principle upon which the device is constructed is such that it lends itself to the production of changes of key where desired.

30 The provision of improved means whereby the regular and uniform tension of the music-sheet is secured, this device involving no interference with the free and rapid rewinding of the sheet.

35 The provision of an operative attachment capable of being applied to an appropriate musical instrument, so that when not in action all parts of said attachment are invisible, but permitting certain parts to be brought to view for the purpose of better controlling the device during operation.

40 The provision of a form of electrically-operated attachment for playing instruments of the pianoforte type wherein are provided improved mechanical connections between individual operating-magnets and their corresponding keys, facilitating the application of an attachment to instruments of different interior arrangement.

45 The provision of improved connecting means for the contact-fingers used in the type of attachment last named, whereby their removal, inspection, and repair are greatly facilitated.

The provision of improved stopping and starting means for a self-playing attachment of the type last named, the said means being adapted for operation by an auxiliary automatic stopping device.

60 The provision in the type of attachment above described of an improved means for properly placing the music-drawer in two different positions, producing operative and inoperative arrangement, respectively, said means also contributing to lessen the danger of short circuits when the music-sheet is not in place.

65 The provision of an improved arrangement of magnets and armatures whereby a device of the type above named may be accommodated within a very narrow space within the instrument to which it is applied, and in general the attainment of the above objects by means of great cheapness and simplicity, combined with reliability, durability, and flexibility of action.

70 In the following specification I have described my invention as embodied in a preferred form suited to use with pianos; but certain features thereof will be recognized by those skilled in this art as obviously useful with certain other forms of self-playing instruments, and I do not limit myself as to these to their application to pianos.

75 In the accompanying drawings, Figure 1 is a front view of my said preferred embodiment, showing the relation thereof to the keyboard. Fig. 2 is a top view of my improved music-drawer and its support. Fig. 80 3 is a view of my attachment seen looking upward beneath the keyboard, certain parts being removed for greater clearness. Fig. 4 is a sectional view of my preferred driving-wheel. Fig. 5 is a rear view of the same removed from its support. Fig. 6 is a plan view of the sliding guide-plate used with my preferred tempo-regulator. Fig. 7 is a side view of my attachment, showing certain parts in section. Fig. 8 is a rear view of some of the magnets with their transmission-rods. Fig. 9 is a sectional view of the preferred transmission-disk used in connection with the driving-wheel shown in Figs. 4 and 105 5. Fig. 10 is a longitudinal section through my music-drawer and contact-finger support, showing the position assumed by the former when the music-sheet is to be adjusted. Fig. 11 is a sectional view through the contact-finger support, showing a modified form thereof and the mode of operation of the ten-

sion-spring. Fig. 12 is a side view of my starting and stopping means. Figs. 13 and 14 are partial bottom views of the two forms of contact-combs shown in Figs. 11 and 10, respectively; and Figs. 15 and 16 are fragmentary top views of a modified arrangement of magnets and armatures.

The form of attachment shown in the drawings is that wherein the motive devices (motor, magnets, &c.) are arranged beneath the rear ends of the piano-keys, being concealed within the piano-case, while the controlling means (fingers and music-sheet and roll) are secured outside of the case proper and beneath the keyboard. This is shown in Fig. 7.

In Fig. 1 the whole attachment is shown from the front, the piano-case being open and only a part of the total keyboard being shown. Here the keys are shown at 1 and the keyboard at 2. There are two horizontal rows of magnets, (shown at 3 and 3'.) These operate, as hereinafter described, upon the keys 1 through upright rods, (omitted from Fig. 1 for greater clearness.) The current for operating the attachment enters by the wires 4, going to the socket 5. The magnets are supported under horizontal platforms 6 and 6', held between end pieces 7 of the main frame, attached to the inside of the keyboard, as by bolts 8. The top piece of this frame is seen from underneath at 9 in Fig. 3. Under the middle of this top piece the two supporting-plates 10 are screwed, as shown in Fig. 3.

The finger-support 11 is hinged at 12 (see Fig. 10) to the plates 10 on the two sides of the rear end of said support. The front of the support is secured under the keyboard by perforated ears 13. (See Figs. 2 and 3.)

The music-drawer 14 slides in ways 15, (see Fig. 10,) so that it may be drawn out into the position shown in Figs. 10 and 2 to adjust the music-sheet or may be pushed back against the stops 16, Fig. 3, when not in use or when being used may be placed as shown in Fig. 3, when the front part of the drawer is preferably in sight of the performer, so as to expose the permanent roll and permit use of expression-marks on the perforated sheet. The last two positions named are shown in dotted and full lines, respectively, in Fig. 7.

The row of contact-fingers or "comb" is contained in a comb-carriage arranged to slide over and parallel to the contact-roller on the music-drawer. The preferred details of construction for carrying out this object are shown in Figs. 2 and 10 and are as follows: The carriage 17 is placed, as shown in Fig. 2, so as to slide upon the floor of the contact-finger support 11, being pressed against the forward wall 18 thereof by the spring 19 or its equivalent. The carriage 17 I have termed the "comb-carriage." At

20 is pivoted the lever 21, extending across the top of the comb-carriage 17 and out in front of the contact-finger support, where it is provided with a handle or knob 22 to facilitate manipulation by a performer. The pin 23, fixed in the top of the carriage 17, passes through an appropriate slot in the lever 21, so that as the knob 22 is pushed to the right or left a corresponding movement is imparted to the carriage 17. The object of this arrangement is to permit the adjustment to right or left across the music-sheet of the contact-fingers. This movement is for the purpose of adjustment to compensate for improper position of the music-sheet on its rollers, or this construction may, if desired, be used to change the key in which any piece is to be played one or more semitones by causing each longitudinal row of apertures in the music-sheet to operate different contact-fingers at will.

The contact-fingers 24, Figs. 10, 11, 13, and 14, are preferably of the well-known shape shown, having each a beak projecting through a slot 25 in the under side of the contact-finger support and dropping upon the contact-roller 26 to close a magnet-circuit in a well-known manner each time it is permitted to do so by arrival under it of an aperture in the music-sheet. As shown in Figs. 13 and 14, I prefer to provide pairs of fingers 24 each separated from the next pair by an insulating-partition 27, all of said fingers in one comb being pivoted upon a single cord 28 or other common pivot extending the whole length of the comb-carriage. This cord should be of insulating material. This cord may be strung through holes in the rear ends of the fingers, as shown in Figs. 10 and 14; but I prefer the arrangement shown in Figs. 11 and 13, wherein each finger has a notch under its rear end which may be dropped over the cord 28. This facilitates removal and replacement of the fingers. As shown in Fig. 2, the connecting-holes 29 for the various fingers are staggered in two rows along one side of the comb-carriage to economize room. From each hole 29 two fine wires 30 are carried to the corresponding pair of contact-fingers 24, being connected thereto near the forward or beaked end of said fingers. This makes these wires more flexible than if they were attached to the rear or pivoted ends of said fingers, thus lessening any tendency the wires 30 might have to interfere with the free movement of the fingers.

In Fig. 10 the wires 30 are shown extending from a connection under the holes 29 to points under the fingers, and this arrangement is within my invention. In this form the conductors bringing current to the various connecting points or holes are connected above them in any well-known manner. I prefer, however, the form shown in Fig. 11

as better calculated to facilitate removal of the fingers 24 at will. Here the wires 30 are connected on top of each finger and carried to screw connections 31 on top of the holes 29, whereby any one may be easily disconnected by removal of its said screw and the finger taken out with its wire 30 without disturbing the others and by simply dropping the contact-finger support on its hinges. In this case the conductors 32, leading to the magnets, may be connected permanently, as by solder, under the respective holes without interfering with removal of the fingers.

The music-drawer carries the metallic contact-roller 26 between the feed-roller 33 on one side and the permanent roller 34, to which is attached the music-sheet, (shown in dotted lines in Fig. 2,) on the other. During performance of a piece of music the sheet starts from the position shown in Fig. 10 in dotted lines, being caught by the hook 35 on roller 33 and wound off of roller 34 and onto said roller 33 by rotation of the latter. After a piece is finished the drawer is pulled out, as shown in Figs. 2 and 10, and is rewound by means of the crank 36 acting through the multiplying-gears 37, 38, and 39, the last of which is fast on the shaft 40, passing through the music-drawer frame and carrying on the inside a brake-wheel 41 and a polygonal socket 42, adapted to receive one end of the shaft of the permanent roller 34.

A light-carrier 43 is pivoted on one side of the music-drawer and carries a spring 44, resting lightly upon the brake-wheel 41 when the drawer is pulled out, as in Figs. 10 and 2. In this position this spring does not materially retard movement of the brake-wheel, and thus rewinding may be quickly accomplished. At the same time a stop 45 on the carrier 43 preferably abuts upon the music-drawer and prevents accidental throwing back of the spring 44. When the drawer is pushed in for performance, as indicated by the arrow in Fig. 10, the carrier 43 comes in contact with the finger-support 11 and is forced under it, as shown in Fig. 11, whereby the spring 44 is pressed down hard upon the brake-wheel 41. In this position the music-sheet is drawn off of the roller 34, and in this position the spring 44 retards rotation of said roller, thus producing a tension which holds the music-sheet taut and well in line at all times.

The performing position of the music-drawer with relation to the finger-support is shown in Fig. 3 and in full lines in Fig. 7. It is desirable, however, that when there is no music-sheet in place in the drawer the latter should be pushed back out of sight and with the roller 26 out of the line of the fingers 24, as shown in dotted lines in Fig. 7. I prefer to accomplish this by the following simple means: In placing the permanent roller 34,

carrying the music-sheet, the left-hand end of its shaft is inserted in the socket 46, sliding in a sleeve 47. (See Fig. 2.) Within the sleeve 47 there is a spiral or other spring, as shown in Fig. 2, tending to force said socket to the right. The length of the roller 34 and its shaft is such that when in place the socket is pushed so far to the left as to protrude considerably, as at 48. Attached to the finger-support is a fixed stop 49, and this is so placed that with the socket protruding, as in Figs. 2 and 3, the part 48 comes against said stop, while with the roller 34 absent and the socket 46 pushed to the right by the spring the stop 48 is not struck and the drawer can be pushed all the way in. (See Fig. 1.) The stop 49 is so placed as to arrest the drawer in the performing position. In this position the gear-wheel 50, Figs. 1 and 2, employed for driving the roller 33, is brought into engagement with the stationary gear 51 directly below it. (See Fig. 3.) This latter gear 51 is carried on a shaft, on the opposite end of which is third gear-wheel 52, intended for driving said shaft. (See Figs. 3 and 7.) This gear 52 is driven by a worm 53 on a shaft 54, at the opposite extremity of which is the friction-wheel 55. The shaft 54 is journaled in a stationary bearing 56 and is kept from longitudinal movement by the wheel 55 and the collar 57. The preferred construction of the wheel 55 is shown in Fig. 9, wherein the metal core 55 is surrounded by a leather or equivalent peripheral covering 58 for deadening noise and securing friction. This covering or tire is secured in place by the plate 59, secured, as shown, to the face of the wheel 55.

The prime mover for the music-sheet is an electric motor 60, which may be of any appropriate form or kind and is pivotally secured at 61 under the keys and preferably inside of the piano-case. The armature-shaft of the motor 60 extends outside of the motor-casing, as shown at 62 in Fig. 4, the same turning in an appropriate bearing 63 and carrying at its extremity a driving-disk, preferably composed of a hub 64 and friction-face 65 fastened thereto. The spring 66, pressing against the hub 64, takes up longitudinal play in the armature and shaft and keeps the driving-face 65 against the friction-tire 58 on the wheel 55. In Fig. 5 is shown a view of the rear of the friction-piece 65, showing its surface of contact with the hub or carrier 64. This friction-piece may be of wood, rawhide, or other appropriate material. The operative surface of 65 is a surface of revolution whose general character is illustrated by the central section thereof. (Shown in Fig. 4.) This curve conforms substantially to the arc of a circle struck from the pivotal center of the motor-support 61. As shown in Figs. 4 and 5, at the center of the friction-piece 65 is a rabbeted hole 67, within

which is placed a loose metal piece 68, held in place by a circular flange impinging upon the rabbet of 67. The bottom of the piece 68 slips upon the face of the hub 64 and is affected only by a slight friction, so that it has no driving effect when brought into contact with the wheel 55. To enable the performer to swing the motor about its pivotal support, I preferably employ a lever 69, extending forward to any point convenient to the performer's hand. For reasons hereinafter explained I prefer to construct this lever in two parts, the outer portion 70 being made to slide on 69, as shown in Fig. 3. The lever 70 passes under a plate 71, Figs. 3 and 6, and carries a recurved pointer 72, which cooperates with a suitable numbered scale on the upper surface of the plate 71. During operation of a piece of music this plate is drawn forward on its supporting ways or slides 73, as shown in Fig. 3, so that the numbered scale is visible to the performer. When not in use, however, the plate is pushed back out of sight, as indicated by the arrow in Fig. 3. The lever-section 70 is connected with the plate, (as by the pin 74, passing through a suitable slot in said plate,) so that it is pushed back out of sight at the same time as the plate 71.

From the construction described it is clear that the motor 60 acts to drive the roller 33 to move the music-sheet by engagement between the friction-surfaces 65 and 58 and consequent operation of the shaft 54, worm 53, and gears 52, 51, and 50. The speed with which the roller 33 moves depends upon the distance of the point of contact between 58 and 65 from the center of 65, the farther this contact from said center the quicker the movement of 33, and vice versa. It is therefore clear that by moving the lever 70 one way or the other, as indicated by opposed arrows in Fig. 3, the motor 60 and wheel 64 65 are tilted one way or the other, varying the point of contact between 58 and 65 and modifying the tempo of the piece being played. When the motor is so tilted as to bring the center of 65 against 58, there will be no driving action and the music will cease. In order to avoid a grinding noise and wearing of the surface 58 by useless friction in this position, the hole 67 is provided. If this hole were left unoccupied, the spring 66 would cause virtual entrance into said hole of a part of the surface 58, and on starting again to drive this roller 33 annoying effort would be caused, as well as noise and wear, when the wheel-surface 58 was made to climb out of the hole onto the engagement-surface.

To avoid this, I supply the loose piece 68, which supports the motionless wheel 58 when central contact is made while avoiding wear, since said piece 68 stands still under these circumstances. This construction makes instantaneous tempo control possible

between extreme positions, since it avoids the loss of time required for changes in motor speed. It also permits of tempo control independently of any other changes in the operation of the device.

It is within the scope of this invention to swing the driving-disk 65 independently of movement of the motor 60; but I prefer the construction shown. It is also within my invention to employ the frictional convex face either on the driving or the driven shaft, and I am not to be confined to that embodiment of my invention wherein the change in speed results from movement of the driving rather than the driven wheel, since change in their relative position is all that is essential in gaining the ends aimed at. Other means than the lever 69 70 might be employed to cause the change in point of engagement described without departing from my invention.

The movement of the individual keys of the instrument is produced by corresponding individual electromagnets, and this I prefer to accomplish in the following manner, it being understood that each magnet is connected with its corresponding pair of contact-fingers 24 in a manner hitherto familiar in this art: The magnets 3 are arranged in a row over a like row of magnets 3', and, as clearly shown in Figs. 1 and 8, they are placed so that each magnet in the upper row comes over the space between two magnets in the lower row. This arrangement is old in this art and is resorted to to economize room. Over each magnet is placed a rocker-armature 74, whose forward end is energized for the purpose of raising the inner or rear end of its appropriate key, as hereinafter described. At the rear end of each key 1 there is a lifting-rod 75, intended to impinge on the under side of the key to push it upward in producing the required tone. The lower end of each rod 75 is provided with an enlargement 76, resting upon the extremity of an adjusting-lever 77, supported by a pivot 78 under the expression-bar 79. This bar extends within the frame 7 over all the magnets, as shown in Fig. 1, and the levers 77 are fixed thereto side by side, there being one of these interposed between each magnet and its corresponding lifting-rod 75. (See Figs. 7 and 8.) The expression-bar 79 is preferably supported by two springs 80, (see Fig. 1,) whereby it is held up against the motive levers 81 and 82, pivoted to appropriate brackets 83 on the frame. When these levers assume the position shown in Fig. 1, the bar 79 is fully raised, and the position of parts shown in Fig. 7 results. The rocker-armature of each magnet 3 in the upper row carries a noise-deadening pad 84, upon which the corresponding lever 77 rests between its pivot 78 and the extremity which carries the lifting-rod. The armatures in the lower row carry extension-

rods 85, bearing similar pads 86 for supporting the levers 77, which they actuate. (See Fig. 7.)

The use of extension-rods for transmitting power from the lower row of magnets is found preferable to carrying down the rods 75 to said row, because in the former arrangement variations in key-spacing existing in different pianos are allowed for by appropriate departures from vertical arrangement of the rods 75 only, the rods 85 being all vertical. This tilting of the rods 75 entirely above the magnets 3 is perfectly practicable, whereas if these rods extended past the upper magnets and downward between them said magnets would prevent such tilting thereof. By use of this construction, therefore, an attachment of this type can be accommodated or adjusted to any piano even after the magnets are all in place.

Considering now the expression device, it may be stated in advance that the form herein shown operates by producing changes in the total throw or travel of the lifting-bar without changing the total movement of the actuating-armature. Since the upper limit of movement of each key 1 and lifting-rod 75 is fixed in any given case, it is clear that variations in the travel of any one lifting-rod must be produced by varying the starting-point or lower limit of travel. It is by doing this that I produce changes of striking force for modulation of tones in giving expression to a piece of music. As shown in Fig. 7, the pad 86 is the fulcrum of the lever 77, whereon said lever is supported. Evidently, therefore, the higher the bar 79 and pivot 78 the lower will be the rear extremity of 77 when the lifting-rod is at its lowest point, as shown in said figure. With the expression-bar 79 and pivot 78 at their highest a maximum part of the movement of the armature 74 is devoted to idle lifting of the rod 75 before it strikes the key 1. In this position of the bar 79, therefore, the tone produced will be at its softest. In proportion, however, as the bar 79 is depressed farther and farther the lowest point of the lifting-rod is correspondingly raised, while the lowest point reached by the rear end of the armature 74 remains unchanged. Consequently the lower the bar 79 is pressed the sooner does the rod 75 touch the key 1 after the armature starts to move and the louder is the tone produced. By lowering the bar 79 as far as possible, therefore, the loudest tone possible is produced, while opposite change of position of the bar lessens the volume of tone. It will be seen that these effects are quite independent of speed of playing and of the use of pedals on a piano when desirable.

Changes in position of the bar 79 may be attained in a variety of ways; but I prefer the following construction. The two levers 87 and 88 are pivoted under the keyboard at 89

and 90 and extend to the front of the keyboard, where they may be moved with or against the arrows shown in Fig. 3. From the inner ends of these levers extend tie-rods 91 92, connected to said levers, preferably by nuts screwing onto the rods, as shown, to permit of proper adjustment in putting together. The tie-rod 91 extends and is fastened to the upper end of the pivoted motive lever 82, and the rod 92 extends and is fastened to the opposite motive lever 81. The lower ends of levers 81 and 82 are so shaped and these levers are so inclined that the upward pull of the springs 80 acts, through the bar 79, to produce in said levers a tendency to tilt away from each other, thus drawing apart also the handles 93 94 of the levers 87 88, Fig. 3. The extreme of this position corresponds to the softest tone produced by the magnets, as before described. To increase the tone volume over the whole register, the handles 93 94 are drawn together, as indicated by the arrows in Fig. 3. This acts, through the rod 91 92 and levers 81 82, to lower the two ends of the bar 79. The amount of effect upon the tone produced depends upon how far the handles 93 94 are so moved.

If the handle 93 be moved alone with the arrow in Fig. 3, the bar 79 will slope upward from right to left in Fig. 1, and the effect in strengthening the tone will decrease from high treble to low bass. On moving the handle 94 alone the opposite inclination of bar 79 will result. Thus either upper or lower register may be controlled by itself in a keyed instrument.

The levers 87 88 may, if desired, be made capable of being fixed in any desired position, and thus music of the desired degree of loudness may be played without the necessity of any performer remaining at the instrument. This I prefer to accomplish by means of a clamp 95 and screw 96 under the handles 93 94, Fig. 3.

I prefer to start my attachment at will and to stop it either by hand or automatically, as desired, by substantially the following means, which I prefer to mount on one end of the contact-finger support. In Fig. 12 is shown a diagram of enough of one arrangement of electric circuits to make clear the general electrical relations of the various parts. The lever 97 is affected by a spring 97^a, Figs. 2 and 12, tending to hold said lever in the position shown in Fig. 12. The said lever remains in electric connection with a conductor 98, leading to one side of the operating-circuit. The opposite side of said circuit leads by wire 99 and through motor 60 to the insulated spring 100 just over the lever 97. On pushing the finger-piece 101 on the side of the contact-finger support in the direction shown by the arrow in Fig. 12 the catch 102 is raised and the lever 97 is brought up into contact with the spring 100, starting the motor 60,

which runs the music-sheet. The lever 97 is held in this operative position (shown in dotted lines in Fig. 12) by means of the pivoted armature 103, which is pushed outward by the spring 104, so as to catch over the lower end of the lever 97, as shown, and hold it down. Now supposing contact made at 97 and 100 and the music-sheet to be running and suppose it to be desired to stop the music-sheet. By pushing the push-button 105 a branch is closed through the coils of the magnet 106, which attracts the armature 103 and liberates the lever 97, so that the spring 97^a is free to open the motor-circuit and stop the motor. It is obvious that where a stopping-magnet 106 is thus used it may be employed to stop the motor automatically at the end of a piece of music by provision of a special circuit-closing finger in the comb, as set forth in my pending application for Patent, Serial No. 723,171, filed July 8, 1899. This arrangement of starting and stopping devices brings the operating means—namely, the buttons 101 and 105—within convenient reach of the performer and renders unnecessary any mutilation of the instrument itself for insertion of push-buttons or the like.

My invention covers a modified arrangement of magnets and armatures whereby with a given length of armature the attachment can be located within a shallower space than is otherwise possible. This is an important point, as many pianos are made with very little room between the wires and the front-board. As shown in Fig. 15, this modification consists in placing the magnets so that the line joining the center of the opposite poles is placed obliquely with respect to the front of the piano. The armatures 74 will then lie as indicated in the drawings, the adjusting-levers 77 still being placeable parallel to the piano-keys, as shown. It is obvious that as thus arranged a given length of armature can be accommodated within a narrower space measured at right angles to the front of the piano than would be requisite in the case of the arrangement shown in Figs. 1 and 7. The degree of inclination which may thus be given to the magnets when placed as close together as they must be in a piano is limited, since the coils of successive magnets will soon touch and prevent further inclination.

In Fig. 16 I have shown an arrangement whereby a greater narrowing of the space occupied is accomplished than in the arrangement shown in Fig. 15. Here the median line of each armature 74 is not parallel to that joining the magnet-poles; but each armature is given an added inclination in the same direction as the magnet under it. The two inclinations are thus added in their effect and the space occupied is reduced to a minimum.

My invention is capable of receiving many

modifications within the judgment of those skilled in this art besides those suggested in the above specification without departing from the scope thereof, and I am therefore not to be understood as limiting myself to the details herein shown and described.

What I claim is—

1. In a self-playing musical instrument, a key, an adjusting-lever under the key, a motive device supporting said lever between its ends, a transmitting means between one end of said lever and said key and means adapted to act upon the opposite end of said lever to raise and lower said end.
2. In a self-playing musical instrument, a key an adjusting-lever under the key, a magnet, a rocking armature over said magnet the end of which armature supports said adjusting-lever between its ends, a lifting-rod between one end of said lever and the inner end of said key and means for raising and lowering the opposite end of said lever.
3. In a self-playing musical instrument, a row of magnets and armatures, a row of adjusting-levers over said armatures, transmitting means operated by movement of said adjusting-levers, a common bar to which said levers are pivoted and means available to a performer for raising and lowering said bar.
4. In a self-playing musical instrument, an expression device operating by movement up or down and an operating-lever pivoted over said device and bearing thereon; in combination with means accessible to a performer for tilting said lever to control the position of said expression device.
5. In a self-playing musical instrument, a row of motive devices for the keys, an expression device extending parallel to said motive devices and adapted to operate by moving nearer to or farther from said motive devices, a spring at each end of said expression device for its support and a separate lever at each end thereof for separately operating each its own end of said expression device.
6. In a self-playing musical instrument, an expression device operating by movement up or down, a spring for supporting said device, a pivoted lever bearing on said device and adapted to push downward upon it when tilted in one direction, a device for manually operating said lever and means for securing said last device in any desired position for adjusting said expression device.
7. In a self-playing musical instrument, an expression device, two levers for separate movement of the two ends thereof, a separate handle for operating each lever and a separate spring at each end of the expression device tending to support said ends.
8. In a self-playing keyed musical instrument, two rows of motive devices one above the other, a lifting-rod connecting each motive device in the upper row directly with cer-

tain of the keys of the instrument, lifting-rods extending from the other keys down to the level of the upper row of motive devices and between them, and an extension-rod 5 from each motive device in the lower row joining each to one of the last-named set of lifting-rods, substantially as described.

9. A self-playing musical instrument having a keyboard, a music-sheet, a sliding support for the same, means for controlling the speed of movement of said sheet, an extensible swinging lever for adjusting said means, a second sliding support under said keyboard to which said lever is attached movable inde- 10 pendently of said first-named sliding support and an indicator on said second sliding support over which the end of said swinging lever moves, whereby the indicator and lever can be brought into view at will while the music-sheet support is out of sight, substantially as 15 described.

10. In an electric self-playing musical instrument, a contact-finger support, a comb-carriage within it, a spring holding said comb-carriage against a straight edge on said support, a pivoted lever over said comb the end of 25 which is accessible to a performer, a connection between said lever and comb-carriage for sliding the latter along said straight edge.

11. In an electric self-playing musical instrument, an insulating-pivot and a series of conducting contact-fingers all supported in 30 common side by side on said pivot.

12. In the comb of an electric self-playing musical instrument, a series of parallel insulating-partitions, a pivot of insulating material threading said partitions and a contact-finger between each two partitions, all of said 35 fingers being pivoted in common side by side on said pivot.

13. In an electric self playing musical instrument, an insulating-pivot and a series of conducting contact-fingers side by side each having an open notch near one end fitting 40 over said common pivot.

14. In an electric self-playing musical instrument, a series of conducting-fingers pivoted side by side, terminals in front of said fingers and connecting-wires between said 45 terminals and fingers connected to the fingers near their rear ends.

15. In an electric self-playing musical instrument, a common insulating-pivot, a series of conducting-fingers removably pivoted 50 side by side on said pivot, an insulating-platform in front of said fingers, removable terminals in said platform and connecting-wires between said fingers and terminals.

16. In an electric self-playing musical instrument, a music-drawer adapted to slide 60 from a position behind the operating position to one in front of the operating position, an offset on said drawer movable inward and outward thereon and a fixed stop in the path of movement of said offset when extended 65

outward, so placed as to strike the same and stop the drawer in its operative position.

17. In an electric self-playing musical instrument, a music-drawer adapted to slide 70 from a position behind the operating position to one in front of the operating position, a socket for one end of the permanent music-roller adapted to be pressed outward when said roller is in place, a spring tending to press the socket inward and a fixed stop so 75 placed as to strike the socket when extended, and stop the drawer in its operative position.

18. In an electric self-playing musical instrument, a row of operating-magnets, each magnet being set obliquely to the direction 80 of the row as a whole, armatures also set obliquely to the direction of the row in the same sense and means for transmitting power from said armatures to operate the instrument.

19. In an electric self-playing musical instrument, a row of operating-magnets, each magnet being set obliquely to the direction of 85 the row as a whole, armatures also set obliquely in the same sense but inclined less than their respective magnets and means for 90 transmitting power from said armatures to operate the instrument.

20. In a self-playing musical instrument, a key, an adjusting-lever under the key, a motive device engaging said lever between its 95 ends, a transmitting means between one end of said lever and said key, and means adapted to act upon the opposite end of said lever to raise and lower said end.

21. In a self-playing musical instrument, 100 an expression device operating by movement up or down, a spring for supporting said device, a pivoted lever adapted to push one end of said device downward when tilted in one direction, and means accessible to a per- 105 former for tilting said lever.

22. In a device for automatically playing keyed musical instruments, a prime mover for each key, a pivoted lever operated by said prime mover and forming part of the trans- 110 mission system between the same and said key and a controller movable during the playing operation for rapidly changing the position of said lever so that it occupies a different position with respect to the prime mover 115 when said prime mover ceases to operate.

23. In a device for automatically playing keyed musical instruments, a motive device for each key, a pivoted lever engaging said motive device and forming part of the trans- 120 mission system between the same and said key and a normally movable controller for rapidly changing the normal distance between the operative end of said pivoted lever and its appropriate key, substantially as de- 125 scribed.

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Witnesses:

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