J. F. KELLY.

PLAYING APPARATUS FOR MUSICAL INSTRUMENTS.

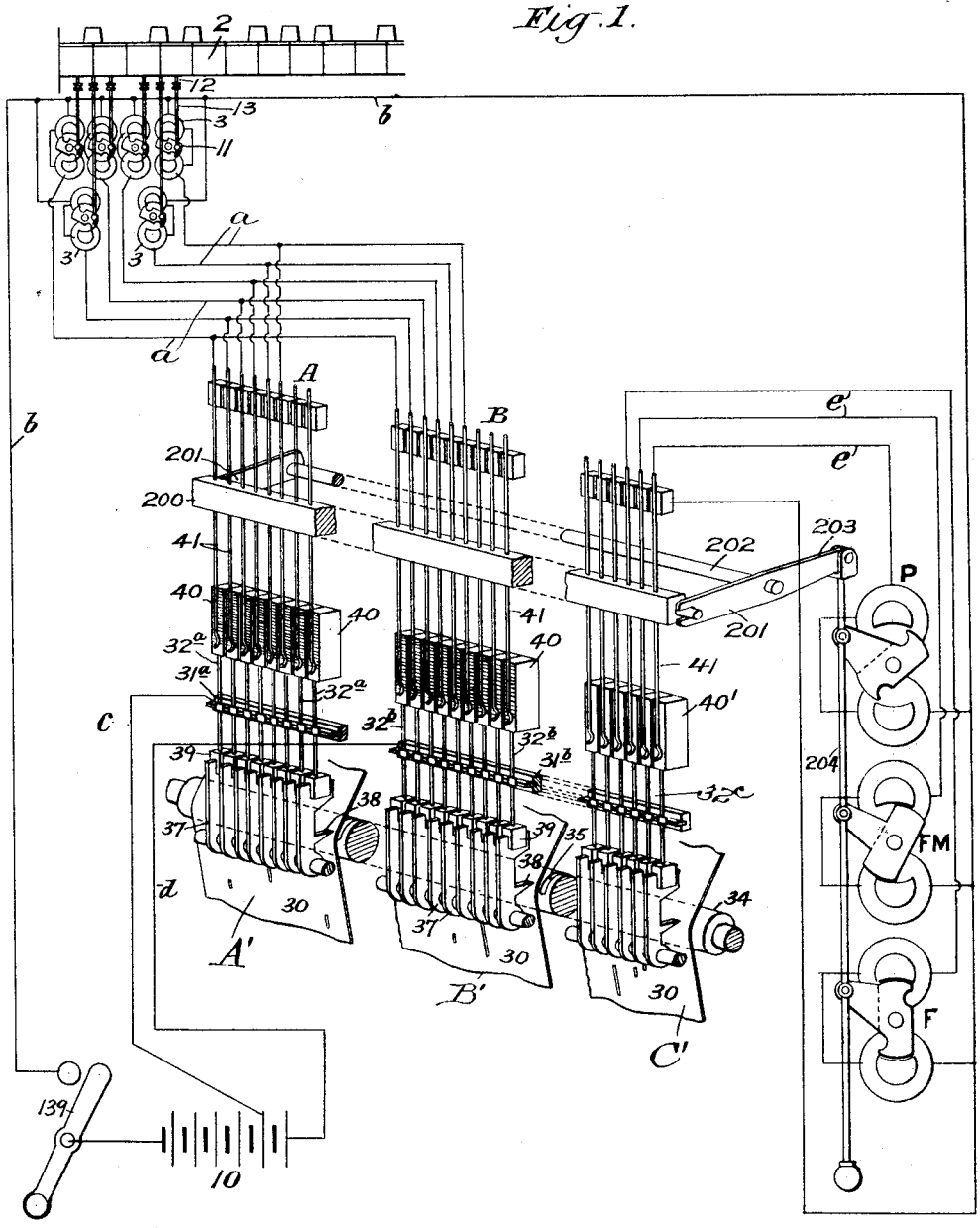
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1,106,819.

Patented Aug. 11, 1914.

2 SHEETS—SHEET 1.

Fig. 1.



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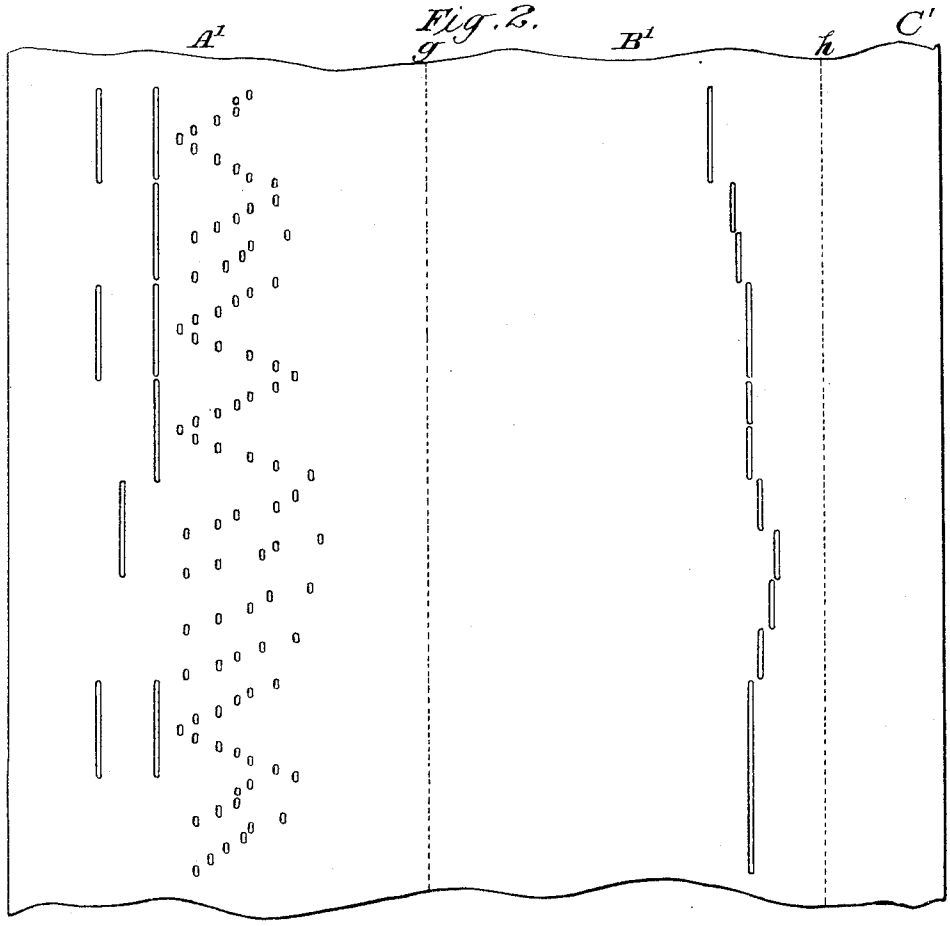
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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PLAYING APPARATUS FOR MUSICAL INSTRUMENTS.

1,106,819. Specification of Letters Patent. Patented Aug. 11, 1914.

Application filed December 6, 1907. Serial No. 405,381.

To all whom it may concern:

Be it known that I, JOHN F. KELLY, a citizen of the United States, residing at Pittsfield, county of Berkshire, and State of Massachusetts, have invented certain new and useful Improvements in Playing Apparatus for Musical Instruments, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to automatic playing apparatus for musical instruments of that class in which the operation of the apparatus for causing the sounding of the tones by the musical instrument is controlled by a so-called music sheet in which the various notes are represented by suitable actuating or controlling devices, usually perforations, positioned transversely of the sheet to determine the particular tones to be sounded, and lengthwise of the sheet according to the time and succession of the tones.

The object of the invention is to provide for accenting or increasing the loudness of certain tones relatively to other tones of a piece or composition played by means of such an automatic playing apparatus. This result is secured in accordance with the invention by providing the controlling mechanism of the playing apparatus with a plurality of sets or series, preferably two sets or series, of controlling devices, the devices of each set being arranged in series together, and the two series or sets being arranged endwise to each other in adjacent position, the operation of the controlling devices of one of which sets or series of controlling devices causes the production of louder tones than are produced by the operation of the controlling devices of the other set or series; and by providing for controlling the operation of such controlling devices a music sheet having its note perforations or other controlling devices divided into two sets located in different longitudinal zones of the sheet, the perforations of one set including those corresponding to tones to be accented, and the perforations of the other set including those corresponding to other tones of the musical composition, and the perforations of each set being arranged in their respective zone transversely of the sheet according to the corresponding set or series of controlling devices of the controlling mechanism to produce the desired tones, and longitudinally of the sheet according to the succession, time and duration of the tones to be sounded. With such a controlling mechanism and music sheet, if the theme or melody of a musical composition is to be brought out or accented, the perforations in the music sheet corresponding to the tones of the theme or melody will be cut in the zone of the sheet corresponding to the set or series of controlling devices which cause the production of the louder tones, while the perforations corresponding to the remaining notes of the composition will be cut in the other zone of the music sheet which corresponds to the set or series of controlling devices which produce the softer tones or tones of normal loudness or strength. So, also, if all or any part of the tones of a particular portion of the composition are to be accented or played with increased strength, the perforations corresponding to such portion of the composition, or the particular tones thereof to be accented, will be cut in the zone of the music sheet corresponding to the set or series of controlling devices which cause the production of the louder tones. The invention provides then for accenting or increasing the loudness of the piece or composition as a whole or any part thereof, for increasing the strength or loudness of particular tones or series of tones relatively to others played before or after such tones or series of tones, and also for emphasizing one or more of a plurality of simultaneously sounded tones. The invention is considered to be especially of importance in providing a simple and reliable way to secure the emphasizing of particular tones played simultaneously with other tones, thus enabling the melody or theme of a composition to be brought out or emphasized above the accompaniment or other part of the composition.

The invention is preferably employed in connection with electrically operated sheet controlled apparatus in which the tone producing devices of the piano or other musical instrument are actuated by the operation of suitably connected electromagnets, and the invention in some of its features relates especially to such apparatus. In applying the invention to playing apparatus of this class, a single set of operating magnets, one for each of the tone-producing devices to be operated, is preferably employed, the connection of the magnets and controlling devices being such that each

magnet may be energized through the operation of one of the controlling devices of each set or series above referred to, so that when any one of the magnets is energized through the operation of the corresponding controlling device of the set or series of controlling devices intended to cause the production of the louder tones, its magneto-motive force will be greater than when energized through the operation of a controlling device in the other set or series. This result is preferably secured by making the electrical connections such that the electromotive force impressed on the magnet circuits by the operation of the controlling devices of the set or series intended to cause the production of the louder tones will be greater than the electromotive force impressed on the magnet circuits by the operation of the controlling devices of the other set or series. This is readily accomplished in an apparatus similar to that shown in United States Letters Patent No. 753,809 granted March 1, 1904, for improvements in automatic playing apparatus for musical instruments, on an application of T. B. Powers and M. R. Jewell, by providing separate contact bars for the contact devices corresponding to the controlling devices of the two sets or series, one of which contact bars is set at a permanently higher voltage than the other.

A full understanding of the invention can best be given by a detailed description of a construction embodying the same in the preferred form, and such a description will now be given in connection with the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of so much as is necessary to an understanding of the invention of an automatic playing apparatus constructed in accordance with the general plan of the apparatus shown in said patent No. 753,809, but changed and modified in accordance with the present invention. Fig. 2 shows a portion of a perforated music sheet made in accordance with the invention and intended for use in a construction such as is shown by the diagram, Fig. 1. The music which is represented by the portion of the music sheet in Fig. 2 is represented at the bottom of the sheet according to the usual system of musical notation.

Referring to the drawings, Fig. 1 shows at the top a series of finger keys 2 representing a portion of the keyboard of a piano. Key operating magnets 3 are located beneath the keyboard, a magnet being provided for each key in the actual apparatus. The key operating magnets, as shown, are of the two-pole form having a pivoted oscillating armature 11 mounted between the poles, and the armature of each magnet is connected with the under side of its corresponding key by connecting rods 12, 13, whereby when any magnet is energized and its armature rotated the key with which the armature is connected will be drawn downward to cause the operation of the corresponding tone producing device of the piano. Each of the key operating magnets 3 is electrically connected through a wire *a* with two contact devices of the controlling or transmitting mechanism through which connection may be made with a battery 10 or other suitable source of electrical energy, and each magnet is also connected with a wire *b* which connects with the other pole of the battery, the magnets being thus located in independent branch circuits controlled by contact-devices forming part of the transmitting or controlling mechanism.

The transmitting or controlling mechanism, as shown, comprises a series A of contact fingers or rods 32^a adapted to make contact with a contact bar 31^a, and a second series B of similar contact fingers or rods 32^b adapted to make contact with the contact bar 31^b, the contact fingers of both series being normally held out of engagement with contact bars during the operation of the instrument by means of rocking fingers 37 which are controlled for causing or permitting the contact fingers to make contact with the contact bars by means of a perforated music sheet 30. The music sheet travels over a bridge 34, and each of the rocking fingers 37 is provided with and supported by a trailing point 38 which engages the music sheet on the line of its support by the bridge 34 which is provided with transverse grooves 35 corresponding in position with the trailing points 38 so that when a perforation in the music sheet comes beneath a trailing point the point will be allowed to project through the sheet into the groove in the bridge 34, thereby permitting the rocking finger 37 and its corresponding contact finger to make the required movement to bring the contact finger into engagement with the bar 31^a or 31^b, as the case may be. The connections from the contact fingers 32^a and 32^b to the key operating magnets 3 are through a series of adjustable resistance devices. Each of these contact fingers connects with a resistance coil 40 from which connection is made by one of a series of adjustable contact terminals 41 to the wire leading to the magnet windings. Each of the operating magnets will thus be connected with two contact fingers, one in the series A and one in the series B. The contact bar 31^a with which the contact fingers of the series A make contact is connected by a wire *c* with a positive pole of the battery 10 for supplying a current of such voltage as is desired for the production of unaccented tones. This may be, for example, a ten volt current. And the contact bar 31^b with which the contact fingers of the series B make contact is connect-

ed by a wire *d* with a positive pole of the battery 10 for supplying a current of higher voltage, as for example, a twelve volt current. When, therefore, any one of the contact fingers 32^a of the series A is caused to engage the contact bar 31^a, circuit will be completed to its corresponding magnet and the magnet will be energized to operate the key to which it is connected with what may be termed normal strength to produce a tone of normal loudness. The strength of action of the magnet and the loudness of the tone produced will, of course, be varied within limits through the variation of the resistance in the magnet circuits by the movement of the contact terminals 41 over the resistance coils 40, as hereinafter described. If, on the other hand, the contact finger 32^b of the series B connected with the same operating magnet 3 is caused to engage the contact bar 31^b, a circuit will be closed to the magnet which will be supplied with current of a greater electromotive force and the magnet will be energized to operate with greater strength and cause the production of a louder tone. Whenever, therefore, any of the key operating magnets are energized through the operation of the controlling devices of the series B the tones produced by the operation of the magnets will be louder than those produced when the magnets are energized through the operation of the controlling devices of the series A. A main switch 139 is inserted in the wire *b* for putting the instrument into or out of operation.

The contact terminals 41 are formed by rods carried by a movable bar 200 and insulated from each other, as by making the bar 200 of suitable insulating material. The resistance coils 40 are also insulated from each other, and the connection between the contact fingers 32^a and 32^b and the rocking fingers 37 is such as to avoid electrical connection between the contact fingers and the rocking fingers, as by having the ends of the contact fingers inserted in suitable socket pieces 39 of insulating material carried by the rocking fingers. The bar 200 is made movable for the purpose of moving the ends of the contact terminals or rods 41 over the resistance coils 40 so as to simultaneously change the resistance of all the branch circuits leading to the operating magnets, thus providing means for changing or adjusting the effective operating strength of such magnets to which circuits may be completed by engagement of their corresponding contact fingers with the contact bars 31^a and 31^b. To provide for the desired movement of the bar 200, it is shown as arranged to be moved by a pair of rocking arms 201 extending from a rock shaft 202 which is rocked through an arm 203 by a longitudinally movable operating rod 204. For automatically shifting the bar 201 for controlling the resistance in the circuits to the key operating magnets, a plurality of resistance or expression controlling magnets are provided, the circuits to which are controlled by the music sheet. As shown, three such magnets, F, FM and P, are provided for causing the bar 200 and the contact terminals or rods 41 to be moved to the position of minimum resistance, medium resistance and maximum resistance, respectively. These magnets are shown as of the two-pole form with rotary armatures similar to the key operating magnets, their armatures being connected with the operating rod 204, and the connections between their armatures and the rod 204 being such that when the magnet F is energized the movement of its armature will cause the bar 200 and contact rods 41 to be shifted to the position shown in which the resistance coils 40 are practically or entirely cut out of the key operating circuits, and when the magnet FM is energized, the other magnets being dead, the movement of its armature will cause the bar 200 and contact rods 41 to be shifted to an intermediate position, and when the magnet P is energized, the magnets F and FM being dead, the movement of its armature will cause the bar 200 and contact rods 41 to be shifted to the position in which all or practically all of each resistance coil will be inserted in its corresponding circuit. The circuits to these magnets F, FM and P are controlled by three contact fingers 32^c, which in turn are controlled by suitably positioned perforations in the music sheet 30, and are adapted to engage a contact bar which may be an extension of the contact bar 31^b, as shown. These magnets are connected with the negative pole of the battery through the return wire *b*, and each of them is connected by a wire *e* with one of the contact fingers 32^c through one of the contact rods or terminals 41, so that when the contact finger 32^c corresponding to either of these magnets contacts with the contact bar circuit to the magnet will be closed and the resistance device shifted accordingly. As there is no necessity of providing a variable resistance in these circuits, no resistance coils are provided between the contact rods 41 with which the wires *e* connect and their corresponding contact fingers 32^c, the ends of the rods, which for uniformity are carried by the bar 200, making sliding contact with suitable contact blocks 40′ occupying the same position with relation to these contact rods and the corresponding contact fingers as the resistance coils 40 occupy with relation to the contact rods and contact fingers connected in the circuits to the key operating magnets.

The apparatus as above described and as shown in Fig. 1 of the drawings differs from that of said Patent No. 753,809 principally in having two series of circuit controlling devices for the key operating magnets, and cir-

cuit connections between the key operating magnets and the controlling devices whereby each magnet may be energized by the operation of a controlling device in each series, and the circuit connections through one series of controlling devices being such that the magneto-motive force of the magnets when energized by the operation of such controlling devices will be greater than when energized by the operation of the controlling devices of the other series. It also differs from the apparatus of said Patent No. 753,809 in the arrangement of the resistance varying means for the key operating circuits so that the resistance coils are stationary and the contact rods or terminals are moved relatively thereto, instead of having the resistance coils moved as in said Patent No. 753,809, the present apparatus in this respect resembling that of my pending application No. 369,520. It will be understood that an actual apparatus would be provided with pedal operating magnets and controlling devices and connections therefor, with an automatic circuit beraking device and means for controlling the position of the bridge 34, and with suitable winding and rewinding mechanism for the music sheet including a suitable motor for driving the same, as in said Patent No. 753,809.

Fig. 2 shows a portion of a perforated music sheet for use in an apparatus such as is shown in Fig. 1. The music sheet of which a portion is represented in this figure may be considered as divided into two main longitudinal zones, the one A′ comprising the portion of the sheet between the left hand edge of the sheet and the dotted line *g*, and the other B′ comprising the portion of the sheet between the dotted line *g* and the dotted line *h*. In the portion of the sheet forming the zone A′ are cut the perforations for controlling the operation of the controlling devices of the series A of the transmitting or controlling apparatus shown in Fig. 1, these perforations being arranged transversely of the sheet according to the tones to be sounded through the operation of the controlling devices of the series A of the transmitting or controlling mechanism, and the relative positions of perforations for causing the production of particular tones corresponding to the relative positions of the corresponding controlling devices of the series A. In the portion of the sheet forming the zone B′ are cut the perforations for controlling the operation of the controlling devices of the series B of the controlling or transmitting mechanism, these perforations being arranged transversely of the sheet according to the tones to be sounded through the operation of the controlling devices of the series B and the relative arrangement of the perforations for causing the production of particular tones corresponding to the relative arrangement of the corresponding controlling devices of the series B. Tones produced through the instrumentality of the perforations in the zone B′ of the music sheet will, therefore, be accented or will be louder than the tones produced through the instrumentality of the perforations formed in the zone A′ of the music sheet. In the particular example shown in Fig. 2, the perforations in the zone B′ are those corresponding to and causing the production of the tones forming the theme or air of the composition, such tones being the same tones as are represented by the accented notes in the music as written at the bottom of the sheet according to the usual system of musical notation, and the perforations in the zone A′ are those corresponding to the accompaniment or remaining portion of the composition, such tones being represented by the unaccented notes in the music as written at the bottom of the sheet. The portion of the sheet between the dotted line *h* and the right hand edge of the sheet in the example shown forms an additional zone C′ giving space for perforations corresponding to the extra controlling devices of the transmitting or controlling apparatus to the right of the series B and including the contact fingers 32^e for the resistance controlling magnets F, FM and P and other expression controlling devices, such as pedal controlling devices, etc., with which the transmitting or controlling apparatus will be provided.

While the controlling devices of the two series A and B of the controlling or transmitting mechanism are preferably arranged as shown in Fig. 1 in order corresponding to the series of keys of the piano, it will be understood that this arrangement of the controlling devices of the two series may be varied as desired, and the relative positions of the perforations in the two zones A′ and B′ of the music sheet will be correspondingly varied. It will be understood also that the invention so far as it relates to the automatic playing apparatus, is not to be limited in its broader aspect to the particular style of apparatus shown, and that so far as the invention relates to the music sheet, it is not to be limited to a music sheet intended for use with any particular style or class of sheet controlled automatic playing apparatus.

What is claimed is:

1. In a sheet-controlled automatic playing apparatus for musical instruments, the combination of a series of operating devices for operating the tone-producing devices of the musical instrument, a series of controlling devices positioned to be controlled by perforations in one longitudinal zone of the music-sheet for controlling the operation of said operating devices to cause the produc-

tion of tones of normal loudness, and a second series of controlling devices positioned to be controlled by perforations in another longitudinal zone of the music sheet for controlling the operation of said operating devices for producing tones louder than those produced through the operation of the controlling devices of the first series and automatically operated movable devices to simultaneously vary the operation of both series of controlling devices.

2. In a sheet controlled automatic playing apparatus for musical instruments, the combination of a series of operating magnets for operating the tone-producing devices of the musical instrument, a series of controlling devices positioned to be controlled by perforations in one longitudinal zone of the music sheet to cause said operating magnets to be energized, and a second series of controlling devices positioned to be controlled by perforations in another longitudinal zone of the music sheet to cause said operating magnets to be energized, a source of electrical energy, connections therefrom to said series of controlling devices whereby the magneto-motive force of the operating magnets when energized through the operation of the controlling devices of the second series is greater than when energized through the operation of the controlling devices of the first series.

3. In a sheet controlled automatic playing apparatus for musical instruments, the combination of a series of operating magnets for operating the tone-producing devices of the musical instrument, a series of circuits for energizing said operating magnets, a series of controlling devices positioned to coöperate with perforations in one longitudinal zone of the music sheet to close said circuits, a second series of circuits for energizing said magnets, a second series of controlling devices positioned to coöperate with perforations in another longitudinal zone of the music sheet to close the circuits of said second series, and means for supplying to the circuits of the second series current of greater strength than is supplied to the circuits of the first series.

4. In a sheet controlled automatic playing apparatus for musical instruments, the combination of a series of operating magnets for operating the tone producing devices of the musical instrument, a series of circuits for energizing said operating magnets, a series of controlling devices for coöperating with the music sheet to close said circuits, a second series of circuits for energizing said operating magnets, a second series of controlling devices for coöperating with the music sheet to close the circuits of said second series, means for supplying to the circuits of the second series current of greater strength than is supplied to the circuits of the first series, a resistance device in each of said circuits, and means for varying the resistance of said resistance-devices simultaneously.

5. In a sheet-controlled automatic playing apparatus for musical instruments, the combination of a series of operating magnets, a series of circuits for energizing said magnets, a circuit-closer in each of said circuits adapted to be controlled by the music sheet, a contact member adapted to be engaged by said circuit closers, a second series of circuits for energizing said magnets, a circuit closer in each of the circuits of said second series adapted to be controlled by the music sheet, a second contact member adapted to be engaged by the circuit-closers of said second series of circuits, and means to supply the circuits of the second series with current of greater strength than is supplied to the circuits of the first series whereby one series of circuits will supply a current of higher voltage than the other.

6. In an automatic playing apparatus, the combination with the operating magnets, of two groups of circuit controlling devices for said magnets, a source of electrical energy, a common return connection from the operating magnets to the source of electrical energy, a common connection from each of the groups of circuit controlling devices to different potential points of the source of electrical energy to supply currents of different voltages to the operating magnets, the two groups of controlling devices being connected in parallel to the operating magnets, a perforated music sheet, the perforations of which are arranged in longitudinal zones corresponding with the groups of controlling devices, whereby said music sheet serves to vary the voltage of the current transmitted to the operating magnets, substantially as described.

7. An automatic playing apparatus for musical instruments comprising, in combination, operating magnets to operate the sound-producing devices of the instrument, two series of circuit controlling devices for said magnets, a source of electrical energy, a common return connection from said magnets to the source of electrical energy, a connection from each of the series of controlling devices to different potential points of the source of electrical energy, the connections from the controlling devices to the operating magnets being connected in parallel, a perforated music sheet, the perforations of which are located in zones corresponding with the arrangement of said series of controlling devices to vary the voltage of the currents to the operating magnets, a resistance in each connection from the two series of controlling devices to each operating magnet, resistance magnets, armatures therefor, connections to the arma-

tures to vary the resistance in each of the said connections to the operating magnets, connections from the source of energy to said resistance controlling magnets, said music sheet having a third zone of perforations to control the operation of the resistance controlling magnets, whereby the current supplied to the operating magnets may be simultaneously varied, as described.

8. In a sheet controlled automatic playing apparatus for musical instruments, the combination of a series of operating magnets, a series of circuits for energizing said magnets, a circuit-closer in each of said circuits, a series of controlling devices adapted to coöperate with perforations in one longitudinal zone of the music sheet to control the operation of said circuit closers, a second series of circuits for energizing said magnets, a circuit-closer one in each of the circuits of said second series of circuits, and a second series of controlling devices adapted to coöperate with perforations in another longitudinal zone of the music sheet to control the operation of the said last mentioned circuit closers, means for supplying to the circuits of the second series current of greater strength than is supplied to the circuits of the first series, a perforated music sheet having its note perforations divided into two sets located in different longitudinal zones of the sheet, the perforations of one set being positioned to coöperate with the second series of controlling devices for causing the production of accented tones, and the perforations of the other set being positioned to coöperate with the first series of controlling devices, and means for supporting the music sheet as it is fed past the controlling device.

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

JOHN F. KELLY.

Witnesses:
ELIZABETH G. FARRELL,
GEORGE P. REES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."