No. 836,827. PATENTED NOV. 27, 1906.

J. P. POOL.

CIRCUIT CONTROLLER.

APPLICATION FILED JUNE 13, 1905.

4 SHEETS—SHEET 1.

Fig. 1.

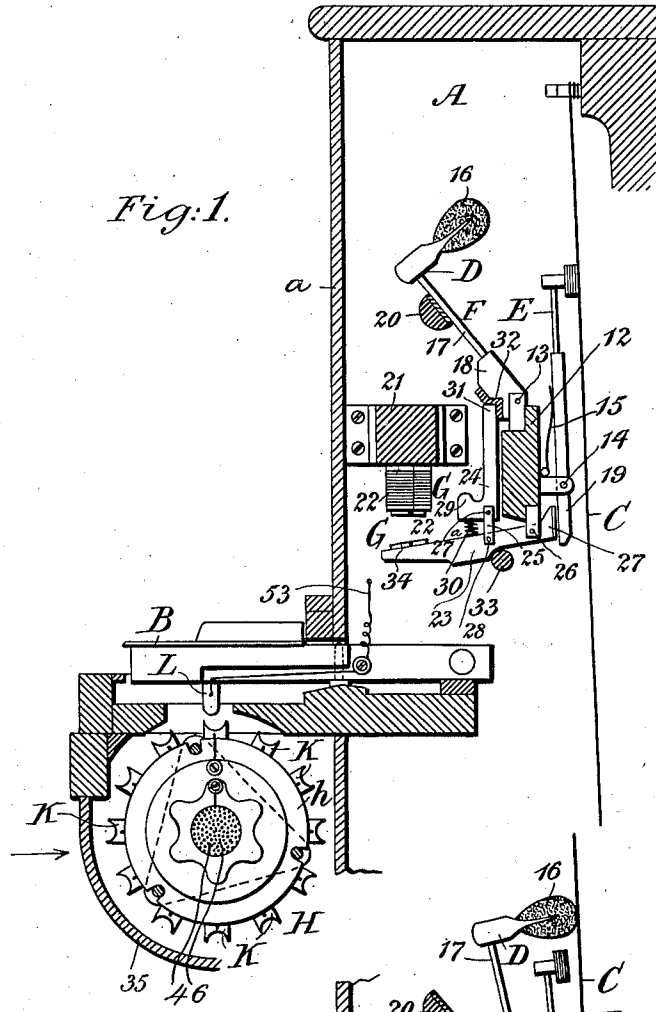
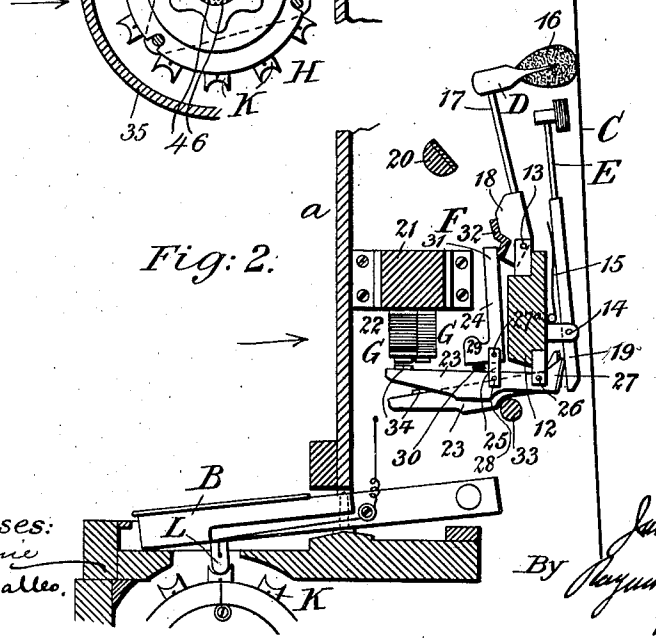


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

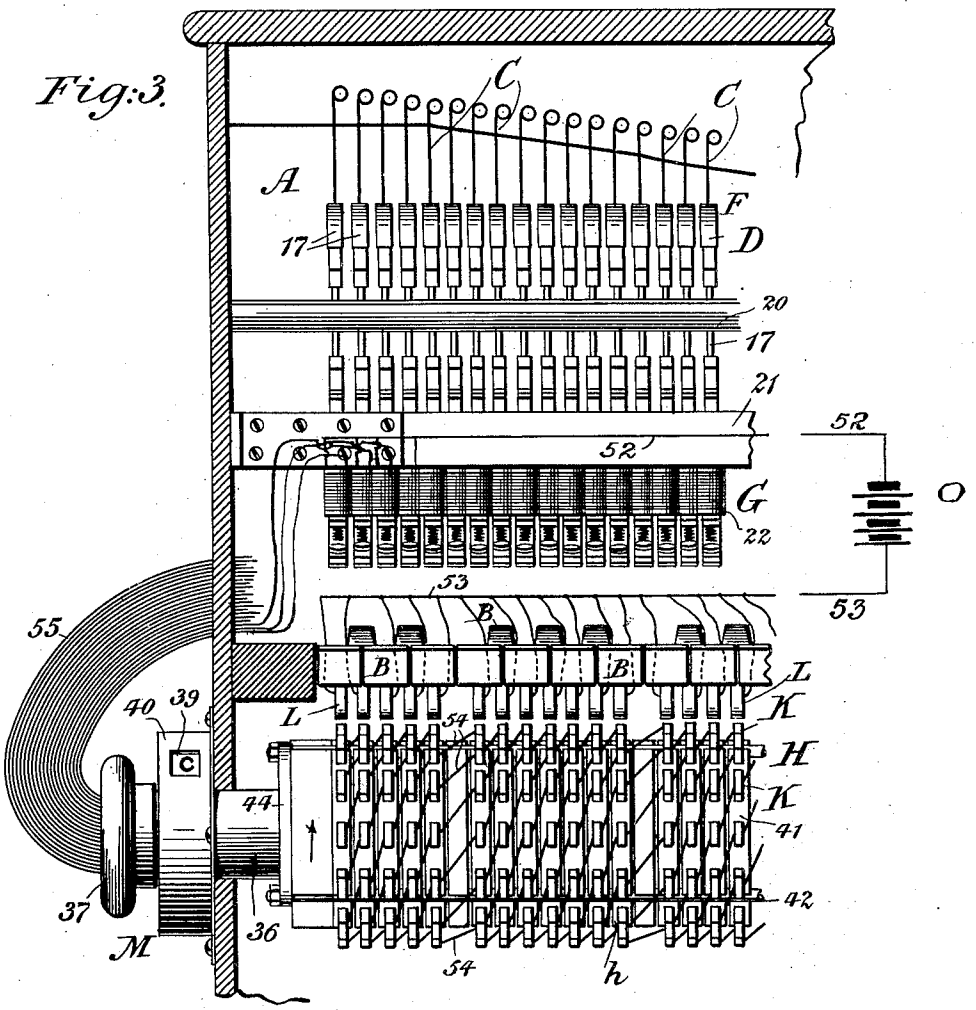


Fig. 4.

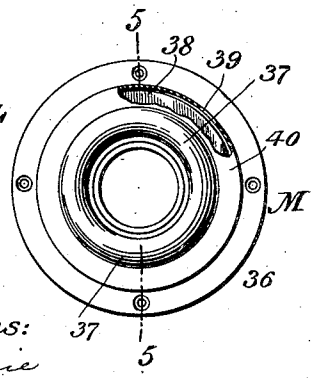
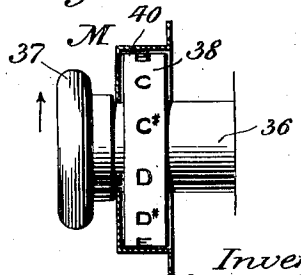


Fig. 5.



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J. P. POOL.

CIRCUIT CONTROLLER.

APPLICATION FILED JUNE 13, 1905.

4 SHEETS—SHEET 3.

Fig:6.

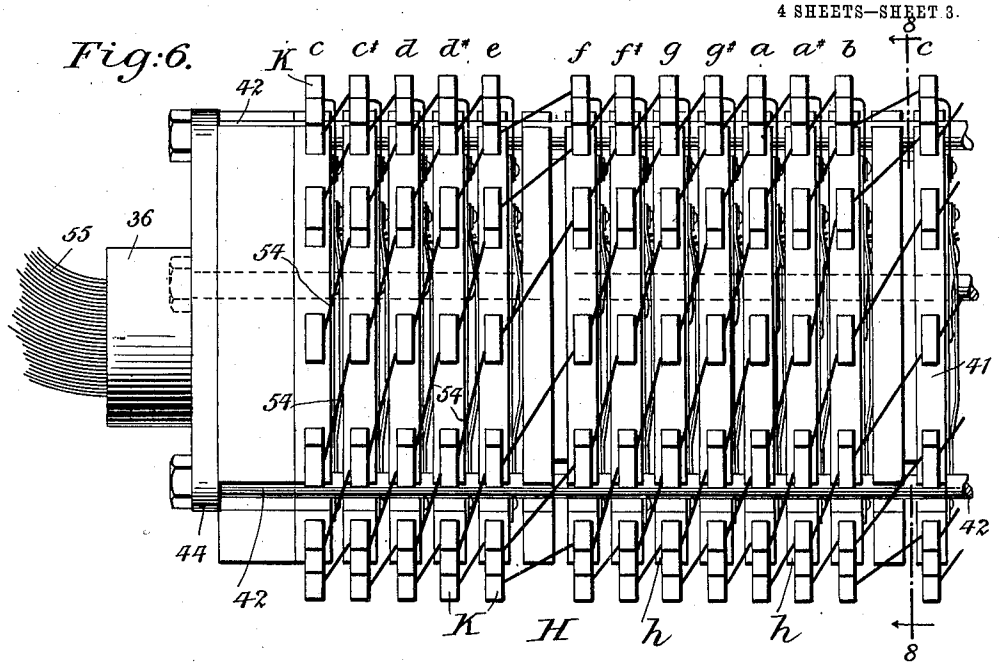


Fig:7.

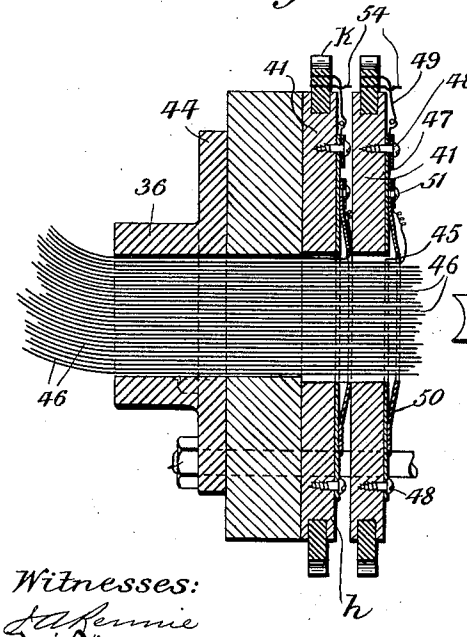
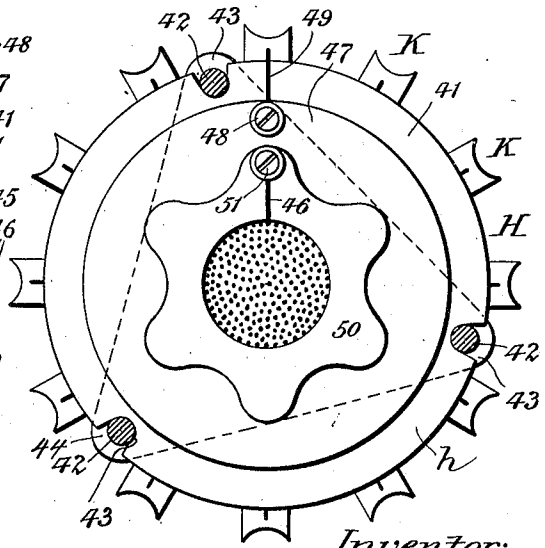


Fig:8.



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No. 836,827. PATENTED NOV. 27, 1906.

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CIRCUIT CONTROLLER.

APPLICATION FILED JUNE 13, 1905.

4 SHEETS—SHEET 4.

Fig: 9.

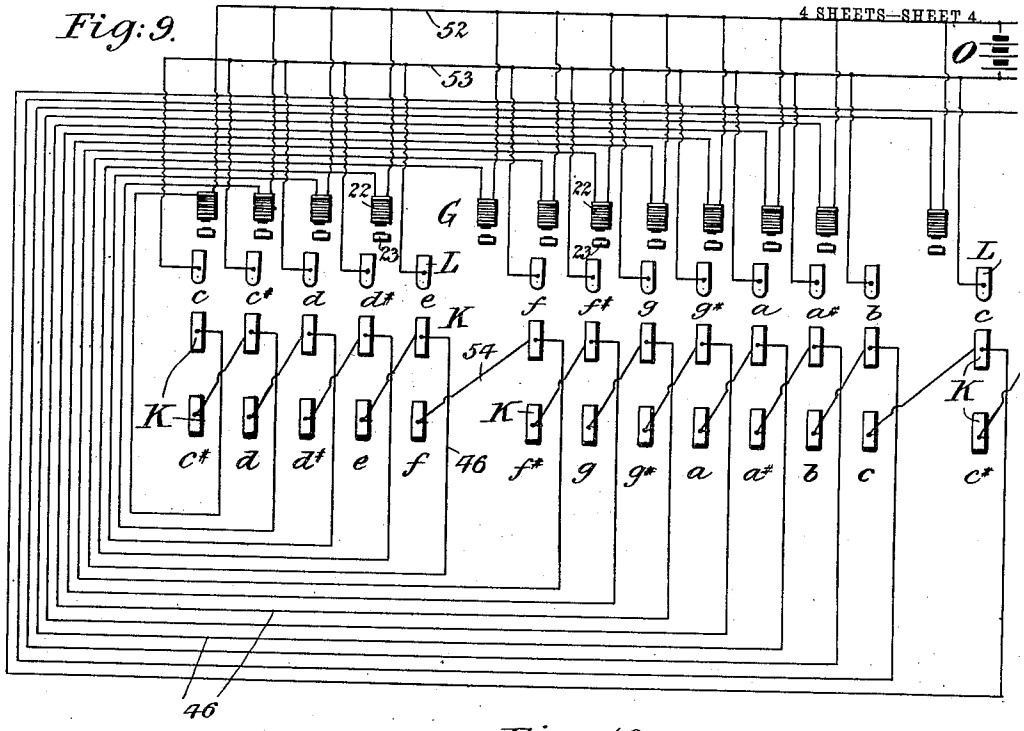


Fig: 10.

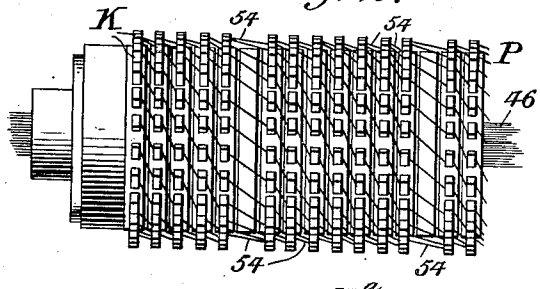
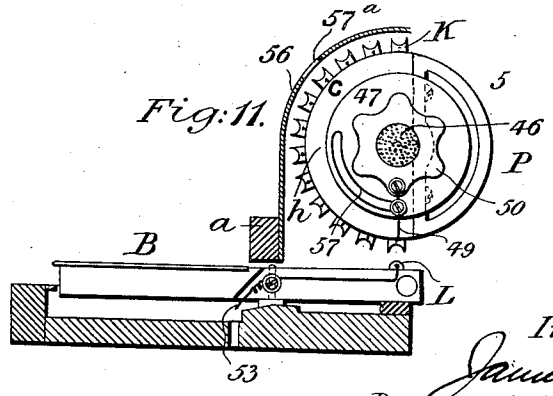


Fig: 11.



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UNITED STATES PATENT OFFICE.

JAMES P. POOL, OF NEW YORK, N. Y.

CIRCUIT-CONTROLLER.

No. 836,827. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed June 13, 1905. Serial No. 265,009.

To all whom it may concern:

Be it known that I, JAMES P. POOL, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Circuit-Controllers, of which the following is a specification.

This invention relates to circuit-controllers, and more particularly to circuit-controllers for musical-instrument transposers operated through the agency of a keyboard, such as a piano or organ; and it has for its particular object to provide transposing means whereby the pitch of the sounds produced in accompaniment with the operation of the keys may be varied, so that without retuning the musical instrument, or in the case of pianos varying the condition of tension of the strings, the pitch of the sounds produced in accompaniment with the depression of the keys may be varied throughout the whole series of keys, hammers, and their respective strings.

The invention has for its particular object to provide musical instruments of the character described which will be relatively simple and inexpensive in construction and generally superior in point of serviceability, simplicity in operation, and general efficiency. The invention will be generally described with respect to its broad features of improvements, then specifically described, and finally pointed out in a series of claims.

In the drawings, Figure 1 is a sectional elevation of the action and keyboard of a piano constructed according to the invention, showing one of the keys, one of the hammers of the same, and one of the dampers of the same, the key and hammer being in inoperative position and the damper being in operative position. Fig. 2 is a similar view, the key and hammer being in operative position and the damper being in inoperative position. Fig. 3 is a sectional elevation of the same, taken in a plane at right angles to that of Figs. 1 and 2 and showing the parts in the same position as in Fig. 1. Fig. 4 is a detailed face view of a controlling and indicating member for showing the "key" in which the piano is to be played; and Fig. 5 is a detail vertical sectional view of the same, partly in full lines, taken upon the line 5 5, Fig. 4. Fig. 6 is an enlarged front elevation of a circuit-controlling member constituting an essential element of the invention looking in the direction of the arrow in Figs. 1 and 2. Fig. 7 is a partial longitudinal axial sectional view of the same, partly in full lines. Fig. 8 is a sectional view of the same, taken at right angles to the plane of section of Fig. 7, upon the line 8 8, Fig. 6, and looking in the direction of the appended arrow. Fig. 9 is a diagrammatic view illustrating the electrical circuit system whereby the electromagnetic operative members are connected. Fig. 10 is a view similar to Fig. 6, showing a modified form of construction; and Fig. 11 is a detail view similar to Fig. 1 and showing a modified form of construction inclusive of the member illustrated in Fig. 10.

Corresponding parts in all the figures are denoted by the same reference characters.

Referring with particularity to the drawings, in which the invention is illustrated as comprised within and adapted to the use of a piano, and Figs. 1 to 9, inclusive, A denotes the casing of an upright piano, of which casing *a* denotes the forward wall, through which extends the keys B, black and white, as in the ordinarily-constructed piano. C denotes the piano-strings, in connection with which operate the hammers D and the dampers E, said hammers D and E being comprised within the "action," (designated by the general reference character F,) the action being inclosed within the casing A. In Figs. 1 and 2 the action complete for one of the strings C is illustrated, and the action for each of the strings is operated by one of the keys B through the instrumentality of electromagnetic means G and a circuit-controlling member H, through the agency of which latter upon depression of the respective key B a circuit is established through the respective electromagnet G. In the drawings a construction and arrangement of parts and members is illustrated which provides for rendering each of the hammers D operative when an electric circuit is closed through its respective electromagnetic means G, the respective damper E being at the same time rendered inoperative.

The circuit-controlling member H comprises a plurality of sections *h*, one for each of the keys B, and each of the sections *h* is provided with a plurality of contact-terminals K, the number of said contact-terminals being preferably the same as the number of tones and semitones in an octave—namely, 12: C, C-sharp, D, D-sharp, E, F, F-sharp, G,

G-sharp, A, A-sharp, and B—and each of the keys B is provided with a contact-terminal L, which is arranged to be engaged with the contact-terminals K of the respective section *h* of the circuit-controlling member H. The circuit-controlling member H extends transversely of and beneath the keys B and is rotatably mounted to permit of bringing the several contact-terminals K of each of the sections successively into the position for engagement by the contact-terminal L of the respective key B. In the drawings only a few of the strings C, action groups F, and keys B are illustrated, and the circuit-controlling member H is shown as provided with a similar number of the sections *h* to represent simply the construction of the piano with respect to the production of the tones and semitones of a single octave; but it will be understood that the invention contemplates the construction and provision of parts and members in sufficient duplication to provide a piano capable of being played in the full complement of seven and one-half octaves or any other complement of octaves, as desired.

M designates a controlling and indicating member whereby the circuit-controlling member H may be adjusted by rotation, so that the key in which the piano is played may be varied as desired without variation in the method and scheme of manipulation of the keys, and whereby the key in which the piano is "set" to be played is denoted when the circuit-controllng member H is in any given position.

A preferred form of construction, relative arrangement, and connection of parts and members of a piano embodying the invention is as follows: Extending longitudinally within the casing A at right angles to and above the keys B is an action-rail 12, with which the hammers D are pivotally connected, as at 13, in position for being actuated into and out of operative contact with the strings C. The dampers E are also pivotally connected with the action-rail 12, as at 14, and are normally forced into engagement with the strings C by springs 15.

The hammers and dampers may be of the ordinary or any preferred form, each of the hammers D being provided with a contact-head 16, a stem 17, and a butt 18 and each of the dampers E being extended below its point of pivotal support 14, as at 19. In their normal positions the dampers rest against the strings C and the stems 17 of the hammers rest in positions inclined away from the strings C and against a stop-rail 20, extending throughout the casing A, parallel with the action-rail 12.

The electromagnetic means G are carried by a bar or rail 21, which extends throughout the casing A, also in parallelism with the rails 12 and 20 and between the action-rail 12 and the front wall *a* of the casing A. The electromagnetic means G comprise a separate electromagnet 22 for actuating each of the hammers D and its respective damper E, each of said electromagnets being connected with and supported by the rail 21. Said electromagnets 22 are closely grouped together in an extended series, as illustrated.

The construction of each of the action groups of the action F apart from the hammer and the damper E comprises in its particular adaptation to the requirements of the features of the invention an armature-lever 23, which is associated with the respective electromagnet 22 and directly actuates the respective damper E, and a jack 24, which directly actuates the respective hammer D and is operated by and pivotally connected with the respective armature-lever 23 through the agency of a connecting plate or plates 25. The armature-levers 23 are arranged in a series beneath and are each pivotally connected with the action-rail 12, as at 26, and each of the same, rearward of its point of pivotal support 26, is provided with a foot 27, which is arranged to bear upon the extension of the damper E beneath its point of pivotal support 14 to withdraw the dampers from the respective string C. The jack 24 is connected with the armature-lever 23 and supported thereby by means of the plate or plates 25 at its lower extremity, as at 27^a, at a point 28 forward of the point 26 of pivotal support of the respective armature-lever 23, the jack 24 extending substantially vertically and the armature-lever 23 extending substantially horizontally. The jack 24 is provided with a forwardly-extending foot 29, between which and the armature-lever 23 is interposed a coil-spring 30, which tends to force said jack 24 rearwardly and toward the action-rail 12. The upper and operative end portion 31 of the jack 24 engages with the hammer-butt 18 in a notch 32, formed in the same, whereby upon elevation of the armature-lever 23 the hammer-head 16 is thrown against the respective string C. The armature-levers 23, of which two are shown in Fig. 2, respectively in depressed and elevated positions, are limited in their depression by a stop-rail 33, which ranges through the casing A parallel with the action-rail 12 and beneath the armature-levers 23. The forward or free end of each of the armature-levers 23 is provided with an armature-head 34, which is arranged directly beneath the core of the respective electromagnet 22 and is directly acted upon in the energization of said electromagnet to lift the respective armature-lever 23, causing the withdrawal of the respective damper E from the respective string C and the throwing of the hammer-head 16 against the respective string C through the instrumentality of the foot 27 and the lever 23.

The circuit-controlling member H is ar-

ranged within an inclosing casing 35, disposed beneath the series of keys B, and is rotatably mounted by means of end bearings 36, of which but one is shown in the drawings, the member H being illustrated, as above set forth, to disclose in full but a certain number of the sections *h*. One of the end bearings 36 is extended exteriorly of the casing 35 and provided with a hand-wheel or knob 37 and indicating disk or wheel 38, which together constitute the controlling and indicating member M, the disk or wheel 38 being provided upon its periphery with musical scale characters arranged to correspond with the longitudinal series of contact-terminals K of the circuit-controlling member H, so that the proper scale character will appear through the sight-opening 39, formed in a cylindrical casing 40, inclosing the disk or wheel 38, to indicate the key in which the piano is set to play. In the drawings the controlling member M and the circuit-controlling member H are in positions of adjustment to permit of playing the piano in the key of "C," the character "c" appearing in Fig. 3 through the sight-opening 39. The cylindrical casing 40 is arranged exteriorly of the casing 35 at one end of the piano.

The circuit-controlling member H comprises, as above recited, a plurality of sections *h*, each of which is provided with a circular body or disk 41, of insulating material, which disks are arranged side by side with faces opposed one to the other and slightly spaced one from the other, being tied together by a plurality of tie-rods 42, extending longitudinally of the member H parallel to its axis of rotation and resting in notches 43, cut in the peripheries of the bodies or disks 41. The tie-rods 42 are bolted at their ends to end plates 44, with which the bearings 36 are connected. The bodies or disks 41 are annular in form, providing circular central openings 45, which register throughout the entire series and in which lie a plurality of electrical conductors or electrical connections 46, each of which is electrically connected with one of the contact-terminals K upon one of the sections *h* of the member H and is also electrically connected with one of the electromagnets 22. As there is one of the electromagnets 22 provided for each of the groups of the action F, in a seven and one-half octave piano there would be ninety of the conductors 46 of the circuit-controlling member H and correspondingly ninety of the electromagnets 22. Each of the electromagnets 22 is also electrically connected with a source of electrical energy O, which is in turn electrically connected with each of the contact-terminals L of the several keys B.

As previously stated, the contact-terminals K of the several sections *h* of the circuit-controlling member H are arranged in series longitudinally of said member H, and there are, as illustrated, twelve of such longitudinal series, which when respectively arranged in positions for the engagement of their several units by the contact-terminals L of the keys of any given octave of tones will enable the piano to be played in the keys designated by the characters appearing through the sight-opening 39 in the casing 40, thus permitting of the transposition of the key without changing the fingering of the keys of any one octave of the piano.

One of the longitudinal series of contact-terminals K, being in the drawings that one which is arranged at the top of Fig. 6 and being the series which is arranged to be engaged by the contact-terminals L when the character "c" appears through the sight-opening 39 in the casing 40, is electrically connected with the several electromagnets 22 by means of the electrical conductors 46 in the following manner: The bodies or disks 41 are of insulating material, the contact-terminals K being set into the peripheries of the same. The contact-terminal K of each disk or body 41, which is electrically connected with one of the electrical conductors 46, is directly electrically connected, as at 48, with an annular plate 47 by a circuit-wire 49, and the respective electrical conductor 46 is at one end connected, as at 51, with a supplemental annular plate 50, which surrounds the group of conductors 46 and bears upon the plate 47 in electrical contact. The plates 47 and 50 are of conducting material, the plate 47 rotating with the respective disk or body 41 and the plate 50 being held against rotation by the respective electrical conductor 46. Each of the disks or bodies 41 is thus provided with a conducting-plate 47, which is electrically connected with one of the contact-terminals K, which it carries and which rotates with the said disk or body 41, each plate 47 also being in electrical contact with a separate electrical plate 50, which is electrically connected with one of the electrical conductors 46, which in turn is electrically connected with one of the electromagnets 22. As each of the electromagnets is electrically connected with a common circuit-wire 52, which extends to the source of electrical supply O, and as each of the keys is electrically connected with a common circuit-wire 53, which extends to the source of electrical supply O, it results that if the longitudinal series of contact-terminals K, which are electrically connected through the plates 47 and 50, carried by their respective bodies or disks 41, with the respective electrical conductors 46, are arranged in positions for electrical engagement by the contact-terminals L of the keys B the depression of any one of said keys will cause the closing of an electrical circuit through one of the electromagnets 22 and the actuation of the respective hammer D and damper E. The elec-

trical connections of the contact-terminals K of the said longitudinal series which are arranged for electrical engagement by the contact-terminals L when the piano is to be played in the key of "C" are such that when any one of the keys of the piano is depressed its normally associated tone will be produced by the energization of the proper electromagnet 22 for the actuation of the proper hammer D and damper E.

To enable the key of the piano to be changed without changing the fingering of the several keys, by merely rotating the circuit-controlling member H by means of the controlling and indicating member M the contact-terminals K of each of the longitudinal series of said contact-terminals are connected together in the following manner: Each contact-terminal of each said longitudinal series, with the exception of those of the longitudinal series which are arranged to be engaged by the contact-terminals L when the piano is to be played in the key of "C," is connected electrically with the contact-terminal in the section *h*, which lies next adjacent to its own longitudinal series and next forward in the direction of the arrow at the left-hand end of the circuit-controlling member H in Fig. 3. When the member H is rotated in the direction denoted by the latter arrow from the position denoted in the drawings, it necessarily follows that as each succeeding longitudinal series of contact-terminals K is brought into position for engagement by the contact-terminals L the depression of any key B will cause the energization of the proper electromagnet 22 to actuate the hammer D as many places removed from the hammer actuated by the depression of the same key when the longitudinal series of contact-terminals (illustrated in the drawings) is in position for engagement by the contact-terminals L of the keys B as is the longitudinal series of contact-terminals K at any time arranged beneath the contact-terminals L removed in serial count from the longitudinal series of contact-terminals K, illustrated in the drawings as beneath the contact-terminals L. In other words, when the character "C" appears through the sight-opening 39 in the casing 40 the depression of the white "C" key will cause the C-string C to be sounded, and when the character "C-sharp" appears through the sight-opening 39 the depression of the white key C will sound the C-sharp string C, because the contact-terminal K, which its contact-terminal L engages, is electrically connected with the contact-terminal K, which is in turn electrically connected through the respective plates 47 and 50 and the respective electrical conductor 46 with the respective magnet 22, which controls the group of the action F, which actuates the hammer D and damper E of the C-sharp string C.

The several circuit-wires which connect the contact-terminals K of the several longitudinal series of the same together electrically in the manner and according to the system described are designated by the reference character 54.

All of the conductors 46 are grouped together to form a cable lying within the central openings 45 of the sections *h*, and said cable (designated by the reference character 55) extends through the bearing 36 at one end of the member H, which is formed hollow to accommodate the same, said cable 55 being thence led in its several conductor units to the proper and respective electromagnets 22.

In the diagrammatic view constituting Fig. 9 the method of wiring is clearly illustrated, and the several circuit-wires are distributed within the casing A in the manner providing for the most convenience and economy. In said diagrammatic view the armature-levers 23 are shown in their proper operative arrangements with respect to the electromagnets 22.

In the modified form of construction illustrated in Figs. 10 and 11 the circuit-controlling member P is illustrated as arranged within a casing 56, arranged above the keys B, and the twelve longitudinal series of contact-terminals K of the same are shown as occupying the segment of but one-half a circle in the cylindrical formation of the entire member B. The arrangement and connection of the circuit-wires 54 are shown as being the reverse of that illustrated in the other figures of the drawings, the direction of rotation of the member P being reversed. The construction of the member P is otherwise identical with that of the member H, with the exception that the circuit-wires 49, connecting the contact-terminals K with the plates 47, are connected each by a separate wire 57 with the respective plates 50, which are connected with the respective electrical conductors 46 to insure unfailing electrical connection of the electrical conductors 46 and their respective contact-terminals K. The casing 56 is provided with a sight-opening 57^a, through which the longitudinal series of contact-terminals K may be directly viewed to permit of noting the key in which the piano is set to be played, and to this end the several longitudinal series of contact-terminals K or one of the contact-terminals of each of such series may be marked with or bear the key character or symbol, as indicated on one of the contact-terminals K at the left-hand end of one of the longitudinal series of the same in Fig. 10.

It will be readily understood that the circuit-controlling member P may be rotated in the same manner as the member H and that a piano in which the modified form of construction illustrated in Figs. 10 and 11 might

be installed would be provided with the remaining features heretofore described to constitute an operative mechanism.

The operation, method of use, and advantages of a piano constructed in accordance with the invention will be readily understood from the foregoing description, taken in connection with the accompanying drawings, and the following summarizing statement: In order to "transpose" in the use of a piano constructed as described and illustrated, it is only necessary to manipulate the controlling and indicating member M so that the character which is exposed through the sight-opening 59 in the casing 40 will be that which indicates the key in which it is desired to play the piano. The longitudinal series of contact-terminals K, which are arranged beneath and in position for electrical engagement by the contact-terminals L of the keys B, determine which of the strings C shall be played by the depression of the several keys of the keyboard, and in going from one key to another it is not necessary to depart from the one system of manipulation of the keys of the keyboard which holds uniformly throughout the playing of the piano in various keys.

By the peculiar construction and method of electrical connection of the electrical conductors 46, constituting the cable 55, the said cable remains stationary in spite of the rotation of the remaining portions of the circuit-controlling member H, permitting unfailing maintenance of circuit conditions in all positions of adjustment of the circuit-controlling member H.

The construction is not unduly complicated and is adapted for long-continued use without derangement of the working parts, and the number of moving parts of the action is relatively decreased with respect to that of the ordinary piano-action, assuring an accuracy and responsiveness of operation which is of advantage in musical instruments of the class described.

Although I have described the invention as applied to a piano, it is manifest that it may be equally readily adapted to musical instruments and other mechanisms and apparatus of a wide range of types.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In mechanism of the character described, an adjustable circuit-controlling member, comprising a plurality of annular sections each of which is provided with a plurality of contact-terminals, electrical connections extending between contact-terminals of one of said sections and contact-terminals of another of said sections, and a stationary cable passing through said annular sections and comprising a plurality of separate electrical conductors electrically connected with said contact-terminals of said sections.

2. In mechanism of the character described, an adjustable circuit-controlling member, comprising a plurality of jointly-movable annular sections each of which is provided with a contact-terminal, and a plurality of separate stationary electrical conductors passing through said annular sections and extending respectively from said contact-terminals.

3. In mechanism of the character described, an adjustable circuit-controlling member, comprising a plurality of annular sections each of which is provided with a contact-terminal, and a stationary cable passing through said annular sections and comprising a plurality of separate electrical conductors extending respectively from said contact-terminals.

4. In mechanism of the character described, a rotary circuit-controlling member, comprising a plurality of annular sections each of which is provided with a contact-terminal, a separate plate upon each of said sections and electrically connected with the respective contact-terminal, a stationary cable passing through said annular sections and comprising a plurality of separate electrical conductors, and a plurality of other plates electrically connected respectively with said conductors and respectively in electrical contact with said plates upon said annular sections.

5. In mechanism of the character described, a rotary circuit-controlling member, comprising a plurality of annular sections each of which is provided with contact-terminals K, a separate plate 47 fixed upon each of said sections and electrically connected with one of the respective contact-terminals K, a stationary cable 55 passing through such annular sections and comprising a plurality of separate electrical conductors 46, a plurality of other plates 50 electrically connected respectively with said conductors 46 and respectively in electrical contact and in sliding engagement with said plates upon said annular sections, and a plurality of circuit-wires each of which electrically connects one of said latter plates with one of said former plates.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES P. POOL.

Witnesses:
RAYMOND M. LESLEE,
M. R. MATTEO.