

Patented Apr. 4, 1865.

Fig. 1.

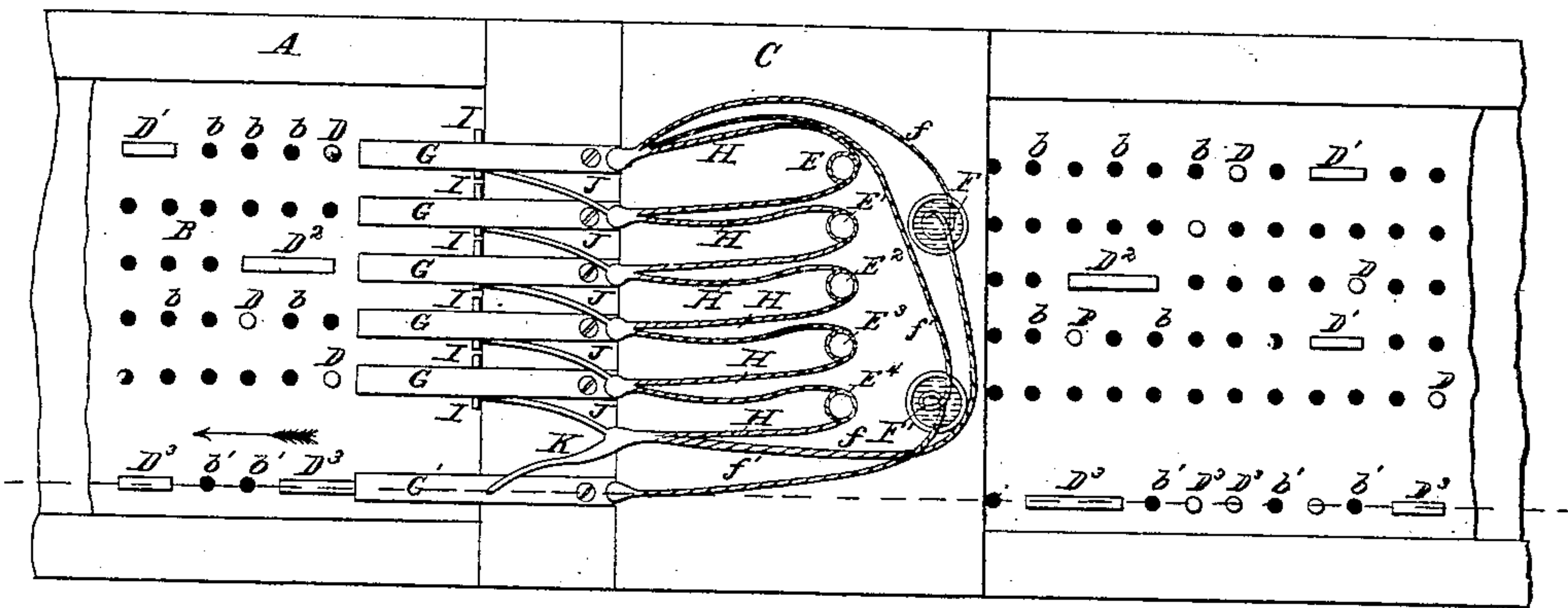


Fig. 3.

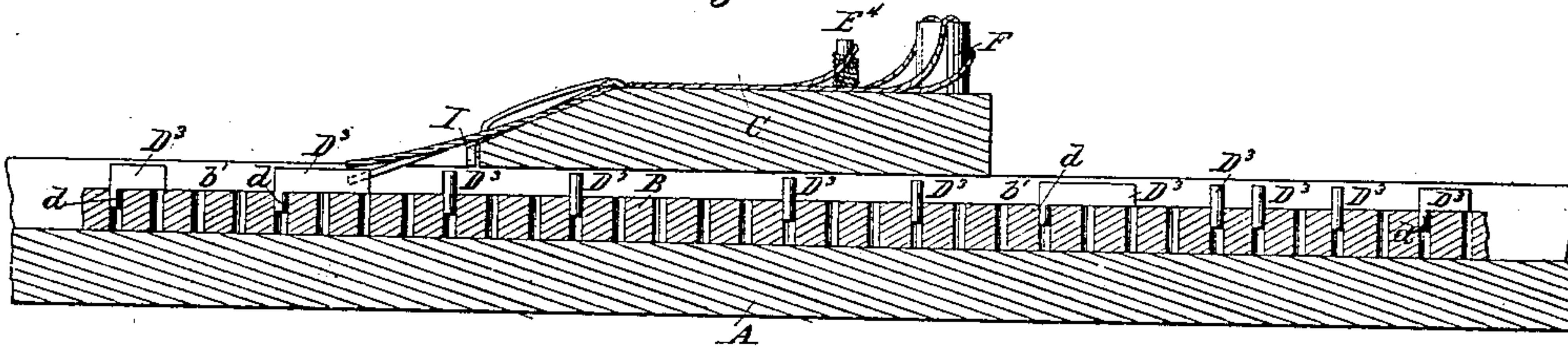
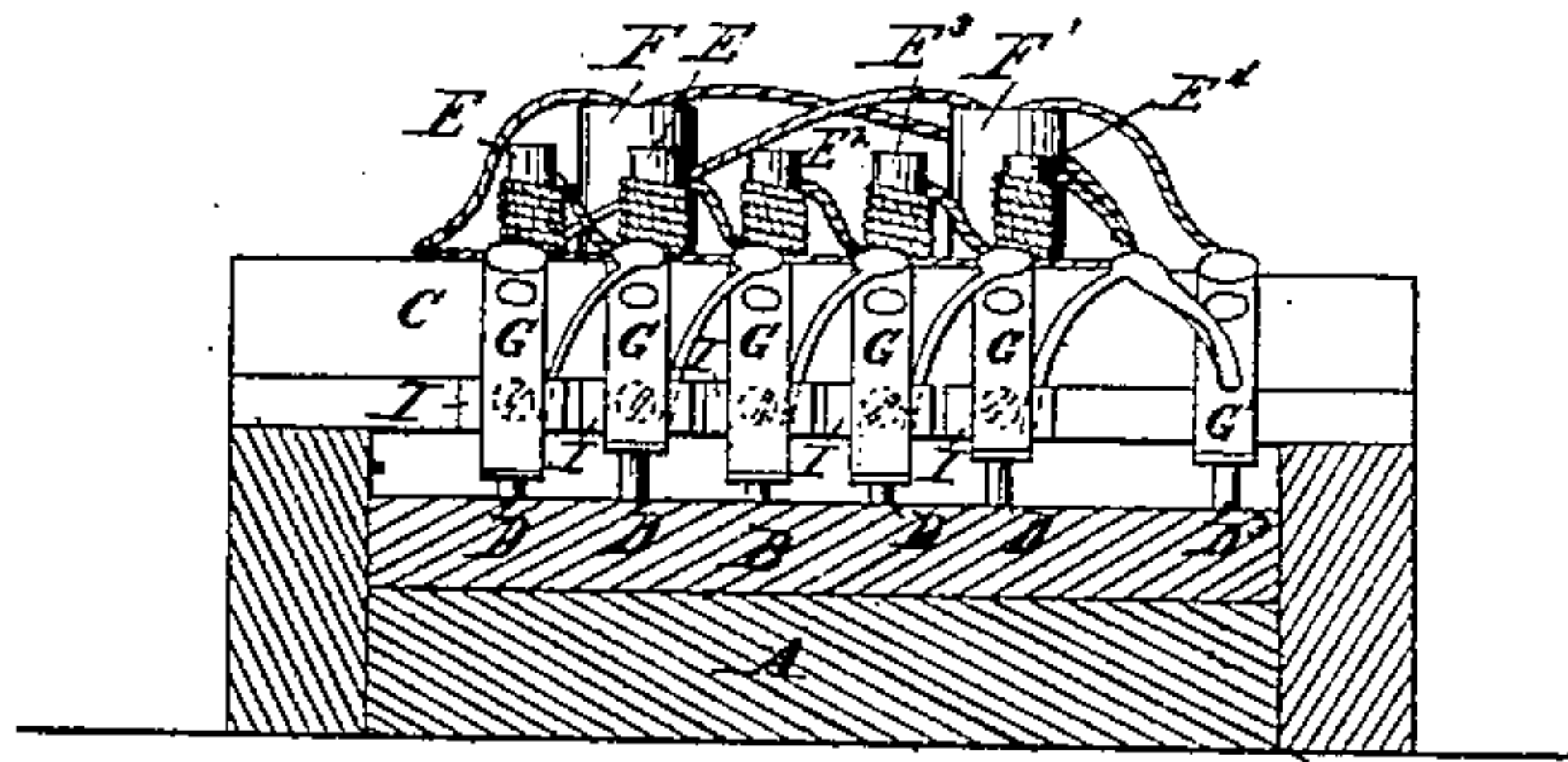


Fig. 2.



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IMPROVEMENT IN ELECTRO-MAGNETIC MUSICAL INSTRUMENTS.

Specification forming part of Letters Patent No. 47,144, dated April 4, 1865.

To all whom it may concern:

Be it known that I, LORENZO WESSON, of Chillicothe, in the county of Ross and State of Ohio, have invented certain new and useful Improvements in Electro-Magnetic Musical Instruments; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan or top view of a portion of a musical instrument illustrating my invention. Fig. 2 is a vertical longitudinal section of the same at $x x$, Fig. 1. Fig. 3 is a transverse section thereof at $y y$.

Similar letters of reference indicate corresponding parts in the several views.

This invention relates to that class of instruments in which, by means of a series of electro-magnets and devices for throwing any of them in any combined or successive order into circuit with a galvanic battery, music may be produced upon any wind or string instrument which is played with keys.

My invention particularly consists, first, in devices for playing music automatically with variable expression and touch, as written by the composer, by operating upon the keys or hammers with stronger or weaker currents, or by operating upon the treadles or valves of bellows of different degrees of compressed air for blowing wind-instruments; second, in the construction or use of a circuit-breaker or circuit-closer provided with movable appliances of any suitable nature and form, by which the same apparatus may be adapted or adjusted to produce any music desired.

In order that others skilled in the art to which my invention appertains may be enabled to fully understand and use the same, I will proceed to describe its construction and operation.

In the accompanying drawings, A may represent a suitable bed or box; B, a music-board adapted to slide or otherwise move thereon, and C a key-board, upon or in which the circuits are made and broken as required, to sound the required notes or produce the required variations of tone or expression.

The music-board B is provided with apertures $b b'$, arranged in longitudinal or transverse rows, the transverse rows being set accurately at equal distances apart, so that the particular holes in each longitudinal range

will be accurately equidistant. The rows running lengthwise are intended to correspond with the various lines and spaces of the music-staff, the treadles and valves of bellows to be worked, and the extra batteries to be thrown into use as more notes are to be played or louder expression given. Otherwise the longitudinal rows of holes correspond in number and position, respectively, to the magnets under the control of the music-board and the extra batteries which are to be used, as hereinafter explained.

D D' D² D³ represent movable type formed with shanks d , by which they are placed and held in the holes $b b'$. The said type are made of a length to correspond to the whole note of music or any subdivisions thereof.

Upon the key-board C are secured a series or range of elastic or yielding levers, G G', each projecting over one of the longitudinal rows of holes in the music-board B, and adapted to be raised by the type D D' D² D³ as the latter pass beneath them.

E E' E², &c., may represent electro-magnets or conductors therefrom.

F may represent the main battery or a conductor therefrom, and $f f$ the conducting-wires by which the poles of the said battery are placed in connection with the respective ends of the range of levers G. F' may represent an extra battery or conductor therefrom.

$f' f'$ are conducting-wires extending between the levers G G' and the battery F'.

H H are conducting-wires extending between the levers G and the magnets E E' E².

I I are disconnected conducting-plates, so attached to the front edge of a key-board, C, one beneath each of the levers G, that the said levers, when in their normal position, will rest upon the edges of the plates H.

J J are conducting-wires, one of which extends from each of the plates I to the stationary part of the lever next in succession.

It will thus appear that each lever is in permanent connection with the plate beneath the preceding lever; also, that each lever is in connection with the plate beneath it while at rest, but that this connection is broken as the levers are raised. It will further appear that the key-board is traversed by two circuits—a long circuit, passing through any or all of the magnets E E' E², and a short circuit, passing directly across through the plates I, wires J, and levers

G. When, therefore, the levers G are all resting upon the plates I the electric current taking the shorter circuit will not materially affect the magnets $E E' E^2$; but in the event of either of the levers G being raised out of contact with its plate I the entire electric current will be passed through the magnet corresponding with such disconnected lever, and the magnetic force thus generated acts in customary manner upon a suitable armature and lever, so as to operate the key of any suitable musical instrument.

K represents a stationary conducting-bar, which is in permanent connection with the last magnet E^4 , and also with the last of the series of plates I. The bar K projects over the lever G' in such a position that the said lever will not be in contact with it while resting in its lower or normal position; but when raised the said lever will be thrown into contact with the bar K and the additional battery F' thus placed in electrical connection with the circuit across the key-board. The raising of the levers G to break the short circuit and divert the current to either of the electro-magnets is effected by type $D D' D^2$, set up in proper positions in the movable board B, and the length of time to produce the required length of sound is regulated by the length of the type. In like manner the raising of the lever G' to bring the extra battery F' into action is effected by the type D^3 , set up in the holes b' of the said movable board. The period during which this increased power of the magnet continues is regulated by the length of the pipe D^3 , and the force of the sound is regulated by the number or power of extra batteries brought into use, any desired number thereof being used, with a lever, G' , and a bar, K, for each. Now, taking the magnet which corresponds to the first long row of holes, one of its wires is connected with the short route outside of that break in it that corresponds to the same long row of holes. Its other wire and one of the wires of the next magnet corresponding to the next row of holes are connected with the short route between the break first mentioned and the next break; so on are all the magnets under control of the music-board connected.

All the positive wires of the different batteries to be used are connected together on one side of the music-board into the long and short circuits. The negative wires of the same batteries terminate all (except one, which may be called a "constant circuit") at the other side of the music-board in the key, and are kept independent of each other, except when thrown into the constant circuit, by the lever, when raised, joining its circuit. Now, it will be seen that every magnet under the control of the music-board has its two wires terminating each on opposite sides of that break in the short route which corresponds to itself. Suppose the circuit lying in the short route, if, then, one or more breaks in the short route be opened, the circuit will instantly be through the magnet or magnets corresponding to the breaks opened. As soon as each break is closed the

circuit will revert back to the shorter route which its closing will afford. Now, having rows of holes corresponding to the lines and spaces of the music-staff and type corresponding to the notes written on the staff, it will be clearly understood how the type may be set up to operate upon the keys, valves, &c., of musical instruments through the agency of electro-magnets. When the type are set up the board is made to slide, by hand or mechanical power, uniformly under the key-board. The type will raise the levers and the circuit will be diverted from the short route into the route through the magnets corresponding to the types and for intervals of time corresponding to the various lengths of type set up.

From the foregoing description it will be understood that my invention, besides playing in perfect tune and in perfect time, differs from other electro-magnetic musical apparatus in affording the most complete means for regulating the expression, the battery power being automatically increased or diminished as required for the greater or less number of magnets used or for the louder or softer tones to be produced. My apparatus will thus automatically play any music with expression equal to that given by the most accomplished performer.

Various other devices may be employed to effect the breaking and the closing of the circuit at the desired places and for the proper lengths of time. To illustrate this I will proceed to describe two modifications of the invention, in both of which the music-board B (which receives the movable type) is designed to remain stationary and the key-board to move instead thereof. On each side of each longitudinal row of holes there lies a channel of mercury. Each magnet under the control of the music-board has its two wires, terminating respectively in the two channels of mercury, lying one on each side of the longitudinal row of holes which corresponds with the said magnet.

Under the first modification there projects down from the end of each lever two metal points into the two channels of mercury which lie on each side of the row of holes which corresponds to the lever. The short route will be through this series of metal points and the mercury into which they dip. These points will, of course, slide into the key-board C, to which the levers are attached, and they may be called "sliding connections." When the key-board is made to slide over the type set up on the stationary music-board the lever will be raised by type suitably arranged for the purpose. The metallic points will thus be lifted from the mercury and the circuit will be diverted from the short route into the magnets which correspond to the levers that are raised on substantially the same principle as that already described. The extra batteries will be thrown in by causing the points to dip in, instead of causing them to be lifted out of, the channels of mercury.

Under the second modification, instead of setting up type corresponding in length and position to the notes of the music, in order to effect the breaking of the short route at the proper places and for the proper lengths of time, holes of insulated mercury will be used for this purpose. The music-board will have its magnet and battery connections, its longitudinal and transverse rows of holes, and its key-board similar to those described under the first modification. All the holes and channels will be filled with mercury. The mercury in each hole in longitudinal row No. 1 will have the metallic connection with the mercury in channel No. 2. The mercury in the holes of longitudinal row No. 2 will have metallic connections with the mercury in channel No. 3, and so on. From the key-board there will project down point No. 1 into channel of mercury No. 1. Point No. 1 connects with Points No. 2. These two points have a difference in their length, so that either must be in the insulated mercury of a hole while the other is sliding over the insulating-division which separates the mercury of the two contiguous holes. Now, as the mercury in the row of holes No. 1 has metallic connection with mercury in channel 2, it will be seen how the short route lies through this series of points in the key-board and the mercury in the holes and channels of the music-board into which they dip. The channels and holes on the music-board being filled with mercury and the key-board made or caused to slide, the circuit would lie in the short route, as described; but if the mercury should be displaced from one or more of the holes it is evident that points No. 2 2' 2'' 2''', &c., must lose their connection with the mercury as they pass over the holes from which it has been displaced. Thus it will be seen how the breaks may be made at the proper places and for the proper periods of time, in order to control the magnets which operate upon the keys, &c., as

described in the specification. In order to throw in extra battery-currents, it would be necessary to keep the mercury in the holes. To throw them out, displace the mercury.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. An electro-magnetic apparatus for playing music with variable power or expression by automatically varying the battery-power exerted on the magnets to accord with the number of magnets in use or with the strength of sound required in any manner, substantially as set forth.
2. A music-board, B, provided with independent movable type acting upon or constituting circuit-breakers or circuit-closers to regulate or govern the tone, power, or length of sounds produced by means of electro-magnetism.
3. The key-board C, connected with a series of magnets, and constructed, substantially as set forth, with two or more circuits by which any of the said magnets may be put in action at will.
4. In combination with the key-board C and series of magnets, the levers G, plates I, and wires J, all arranged as described, and adapted to operate substantially as and for the purposes set forth.
5. In combination with the electro-magnets E E' E'', music-board B, and additional battery F', the lever G', operating, substantially as described, to open communication between the additional battery and magnets when required.

The above specification of my improvement in electro-magnetic musical instruments signed this 2d day of May, 1864.

LORENZO WESSON.

Witnesses:

W. B. BURR,
H. GRAMBO.