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M. GALLY.

PNEUMATIC ACTION FOR MECHANICAL MUSICAL INSTRUMENTS AND PLAYERS.

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NO MODEL.

Fig. 1

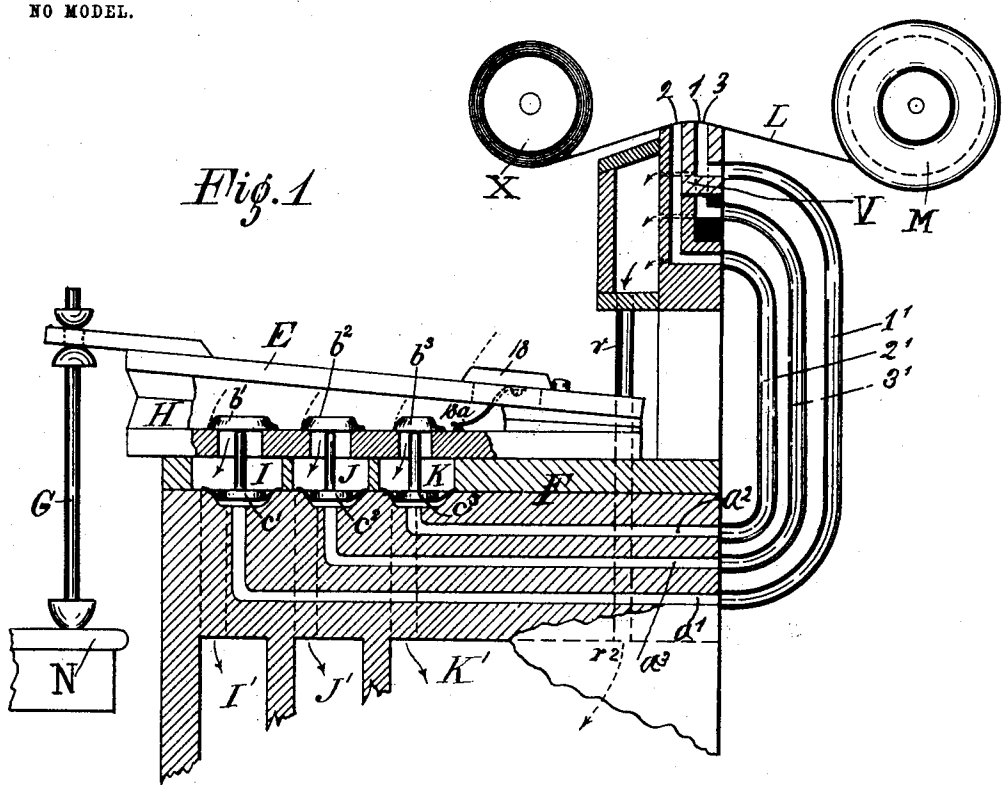
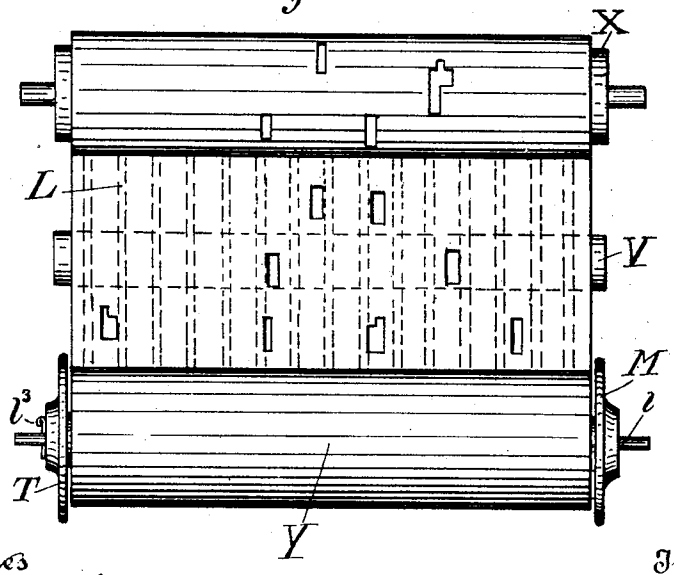


Fig. 2



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UNITED STATES PATENT OFFICE.

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PNEUMATIC ACTION FOR MECHANICAL MUSICAL INSTRUMENTS AND PLAYERS.

SPECIFICATION forming part of Letters Patent No. 752,060, dated February 16, 1904.

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To all whom it may concern:

Be it known that I, MERRITT GALLY, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Pneumatic Action for Mechanical Musical Instruments and Players, of which the following is a specification.

In the accompanying drawings, Figure 1 is a view of the action, partly sectional, showing the several parts in operative position; and Fig. 2 is a plan view of that part of Fig. 1 containing the tracker and music-sheet.

My invention relates to the matter of "expression" in automatic or mechanical music, and especially to the production of expression in selected individual notes of a musical composition and to apparatus for securing accurate operation of the mechanism therefor.

The production of "musical expression" in automatic or mechanical music has heretofore been largely confined to giving variety of tone to the "parts" of a musical composition or to varieties by octaves or divided parts of the scale, as by automatic or mechanical operation of the stops and swells of an organ.

The gist of my present invention is to so improve certain parts of the pneumatic apparatus as to be able therewith to fully and exactly control each and every individual note of the scale, producing individual quality to any single note or number of notes in a chord or any part of a musical composition.

In Fig. 1 of the drawings accompanying this specification the tracker-board V is shown with three independent ducts to each letter of the scale. Instead of the old plan of only one duct to each letter I use a plurality of ducts, two or three or even more.

Examining Fig. 1 of the drawings, it will be seen that instead of one exhaust-valve for the power-pneumatic operated by a single primary pneumatic the power-pneumatic has three valves each operated by an independent primary from one of the three ducts of the tracker, all three representing a single letter of the scale and operating only one power-pneumatic for a single note-key of the instrument. The valves of the power-pneumatic are shown of different sizes to be used in different combinations, but may all be of one size, if desired, and be used only as accumulative for different powers and quickness of stroke.

As there are three ducts in the tracker-board for each letter of the musical scale, so there are three lines for perforations in the sheet for each letter of the scale. Each line of each of the three perforations longitudinally of the music-sheet represents one of the three valves in each power-pneumatic, and any combination of the three lines in the music-sheet represents a corresponding combination from the three valves of the power-pneumatic. Therefore if a perforated note in the music-sheet is made only on one line of the three, one valve of the power-pneumatics will be operated. If the note in the sheet is made on two of its longitudinal lines, the two valves corresponding to these lines will be operated in combination, and so with a combination of three or more, if so used.

In Fig. 1 of the drawings, the exhaust-chamber B^2 and the pneumatic chamber F are both divided into a number of compartments, as I J K I′ J′ K′. The compartments I J K I′ J′ K′ may be, if desired, exhausted by means of different bellows, one for each of the three valves of the power-pneumatic and of different air tension. The devices for producing such variety of air tension are so common that they do not require explanation here; but it is only necessary to indicate the use of the variety of air tension in the combinations for results. By a variety of air tensions a greater variety of conditions is secured with the operating-valves of the power-pneumatics controlled by the tracker-board and sheet, as described, and is a useful element to secure greater variety of effects by a greater variety of combinations.

The operation of the mechanism, as shown in Fig. 1, is as follows: The group of three ducts 1 2 3 in the tracker represents a single letter of the scale. So, also, the power-pneumatic E H, with its three valves b' b^2 b^3 and three primary pneumatics c' c^2 c^3. Each duct in the tracker leads to its primary pneumatic

and operates its valve distinctly from the others. Now if the perforated note in the sheet is cut only on the line of one duct of the three its valve alone will be operated and a longer time will be consumed in exhausting the power-pneumatic than if more of the valves were operated together, and the movement of the power-pneumatic will be slower, producing less momentum of the hammer of the instrument, and therefore of less power of stroke. Further, if a varied tension of air is used greater and less power can be produced and a greater variety of difference can be secured. The measure of power exerted on a piano-key and the momentum of the piano-hammer when it leaves its jack determines the character of the stroke of the hammer on its string.

The perforated music-sheet may be used interchangeably on piano, organ, or other musical-instrument action and may operate either pneumatic apparatus, mechanical fingers, jack devices, or electrical appliances, as the case may be.

The general operation of the pneumatic mechanism is as follows: The group of three apertures 1 2 3 in the face of the tracker V, representing a single note of the scale, leads through the tracker to the three extension-tubes a' a^2 a^3, which lead to the pockets of the primary pneumatics c' c^2 c^3. The three primary pneumatics operate the valves b' b^2 b^3. All these three valves open into the single pneumatic motor E H. When a perforation in the music-sheet opens only one of the apertures in the tracker, only one of the exhaust-valves in the pneumatic motor E H is operated, the motor-bellows is collapsed, and the power stroke made by this valve alone. On the surface of the motor-bellows is an automatic flush-valve 18, which is provided with a light spring-opener 18^a. This valve, which is normally closed, is held closed during the collapse and the hold of the motor-bellows, the power of the spring 18^a being overcome by the exhaust; but as soon as the exhaust is cut off by the closing of the exhaust-valve, occasioned by the closing of the aperture in the tracker, the spring 18^a forces open the valve 18, and the motor-bellows is flushed by the outside air until its upper board reaches its normal position, when the flush-valve is again closed. It will be seen that the motor may be operated from any one of the tracker-apertures 1 2 3 or any combination thereof without any loss from the flush-valve, as said valve is normally closed and can be opened only at the close of the hold of any stroke, and then only until the motor-bellows is filled and ready for another stroke. The amount of exhaust is increased or diminished by using the different apertures in the tracker accumulatively or in different combinations, which will operate corresponding numbers or combinations of the exhaust-valves, and thus by more quickly or slowly exhausting the motor-bellows more or less speed is given to the striker, and as a result greater or less momentum to the hammer of the instrument.

The measure of atmospheric pressure on the upper board of the motor remains constantly the same, while one tension of exhaust is used, whether one aperture in the tracker or more are used for the blow, and therefore the direct power by pressure is unchanged. If it is desirable to produce greater or less power by pressure, it is done by differences of air tension in the air-chambers, as hereinbefore stated. The different exhaust-valves may be served by the different air-chests I J K, with different tensions of exhaust permanently or shifted from one to another by any well-known means.

The letters "A," "A♮," "B," "C," "C♮" "D" are not used in the drawings as reference-letters, but to indicate letters of a musical scale and should so be read.

When in the use of the mechanism changes in speed of movement are depended upon for changes in power of tone, it is to be understood that the musical instrument used is to be a piano or other instrument in which a hammer stroke produces the tone.

In Fig. 1 the pneumatic motor is shown pivoted to a push-pin or striker G, which is placed above the key of the musical instrument. The striker can be arranged to act in an upward direction by placing the motor under the opposite end of the key or the striker may be arranged to operate directly upon one of the jacks of the instrument action. The striker is not intended to strike directly on a piano-string, as without the intervention of a "jack mechanism" it would be inoperative.

The push-pin or striker G when intended to be applied directly to the key of a musical instrument, as shown at N in Fig. 1, is terminated with a "touch-piece" covered with proper material to prevent noise from stroke contact.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a pneumatic action for an automatic or mechanical musical instrument or player; a pneumatic motor for each of a series of the sound-producing devices of a musical instrument; a tracker having a plurality of apertures, comprising a separate group for each sound-producing device; the pneumatic motor having a plurality of outlets with exhausting-valves; an inlet to reinflate the motor, having a valve normally closed, and means for closing all of the outlets when the inlet is opened.

2. In a pneumatic action for an automatic or mechanical musical instrument or player; a pneumatic motor for each of a series of the sound-producing devices of the instrument; a tracker having a plurality of apertures, com-

prising a separate group for each sound-producing device, and a perforated music-sheet therefor, the pneumatic motor for any one of the sound-producing devices, having a plurality of exhausting-outlets with valves therefor; an inlet-valve normally closed; and means controlled by the tracker and a perforated music-sheet for operating the exhaust-valve singly and in varying combinations of two or more valves.

3. A pneumatic key-motor, having a plurality of exhaust outlet-valves; inlet means for inflating the motor; and means for cutting off the inflating supply of air when any one or more of the inlet-valves are open.

4. A pneumatic key-motor, having a plurality of exhaust-valves; an inlet inflating-valve; said inflating-valve being held closed by the exhaust when any one or more of the exhaust-valves are open.

5. A pneumatic key-motor, having a plurality of exhaust-valves; an inflating-valve, normally closed; said inflating-valve being held closed by the exhaust when any one or more of the exhaust-valves are open, and a spring to open the inflating-valve when the exhaust is cut off.

6. A pneumatic key-motor having a plurality of exhaust outlet-valves; an inlet inflating-valve, normally closed; means for opening the inflating-valve when the exhaust is cut off.

7. A pneumatic tracker; a collapsible pneumatic key-motor, having a plurality of exhaust outlet-valves controlled by a corresponding number of apertures in a pneumatic tracker; the motor normally inflated and closed to the outside air and the exhaust-valves closed; a reinflating-valve; said motor to be collapsed by the opening of any one or combined number of the exhaust-valves; and reinflated by the reinflating-valve when the exhaust-valves are closed.

8. A pneumatic tracker; a pneumatic key-motor having a plurality of exhaust outlet-valves controlled by a plurality of apertures in the pneumatic tracker; and an inflating-valve, to act in combination with any one, or combined number of the exhaust outlet-valves.

9. A pneumatic tracker; a pneumatic key-motor, having a plurality of exhaust-outlets for collapsing the motor, controlled by a plurality of tracker means; and an inflating-valve acting in common with one and all of the exhaust-valves.

10. In a pneumatic motor for an automatic or mechanical musical instrument or player; a plurality of exhausting-outlets, separate controlling-valves for the outlets from said motor; a separate exhaust-chamber for each outlet, the several exhaust-chambers having different air tensions; and means for operating said valves in varying combinations.

11. In a pneumatic action for an automatic or mechanical musical instrument or player; a pneumatic motor having a plurality of exhausting-outlets; separate controlling-valves for said outlets; an inlet for reinflating the motor, the inlet having a valve normally closed, and operative for ingress of air only when the outlets are all closed; a separate air-chamber for each outlet, the several air-chambers having different air tensions; and means operated by a pneumatic tracker and perforated music-sheet, for operating the outlet-valves singly or in different combinations.

12. A pneumatic motor for operating a single note-key of an automatic or mechanical musical instrument or player; exhausting-outlets for the motor; a separate air-chamber for each outlet, the several air-chambers having different air tensions.

13. A pneumatic motor for operating a single note-key of an automatic or mechanical musical instrument or player; two or more exhausting-outlets for the motor; a separate air-chamber for each outlet, the several chambers having air of different tensions; valves for all the outlets; and means for operating the valves, singly and in different combinations of two or more valves.

14. In an automatic or mechanical musical instrument or player, a pneumatic motor; a tracker having a group of apertures for controlling a motor for operating a single sound-producing device; each of the apertures having an independent air-channel, with means for operating the motor; the means controlled by one of the group of apertures, operating the motor with air-exhaust of one tension; and the means controlled by another of the group of apertures, for operating the motor with air-exhaust of a different tension.

15. In a pneumatic action for automatic or mechanical musical instruments or players; a pneumatic motor; a tracker having a group of air-duct apertures for controlling a single pneumatic motor for operating a single note-key of a musical instrument; a plurality of air-duct outlets for the motor; and an automatic inlet-valve for reinflating the motor; the valve operated by the movement of the motor-bellows board.

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