L. B. DOMAN.

MOTOR ACTION FOR SELF PLAYING MUSICAL INSTRUMENTS.

APPLICATION FILED SEPT. 4, 1906.

1,067,215. Patented July 8, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

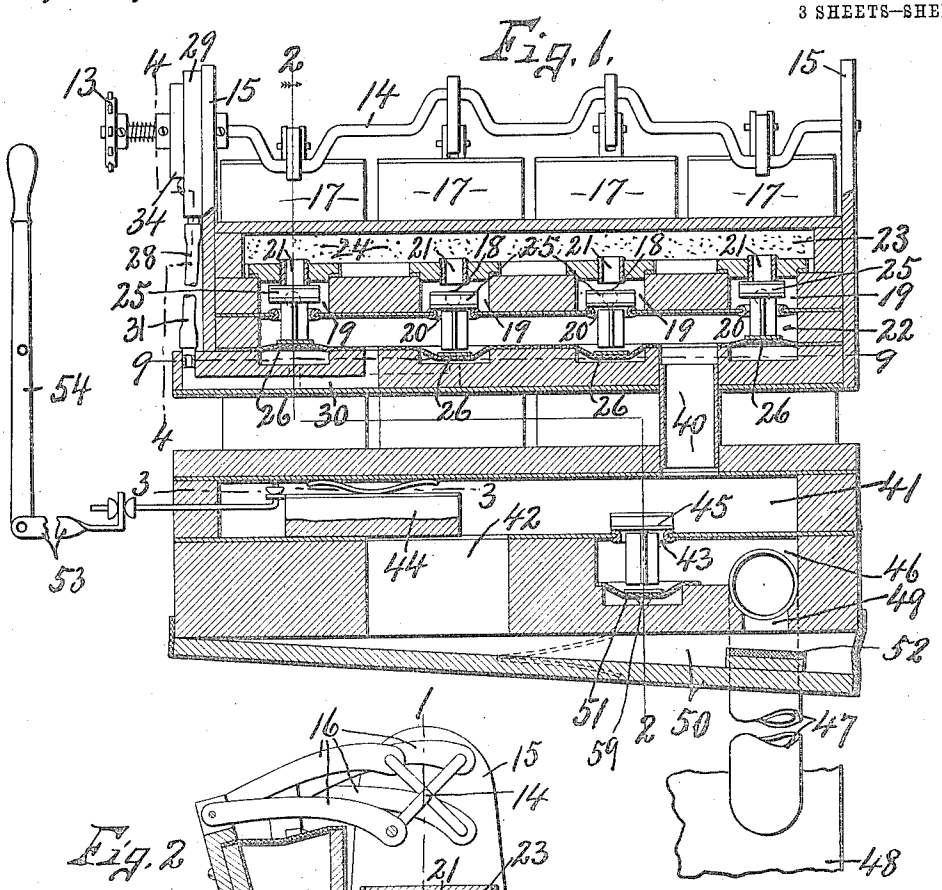


Fig. 2.

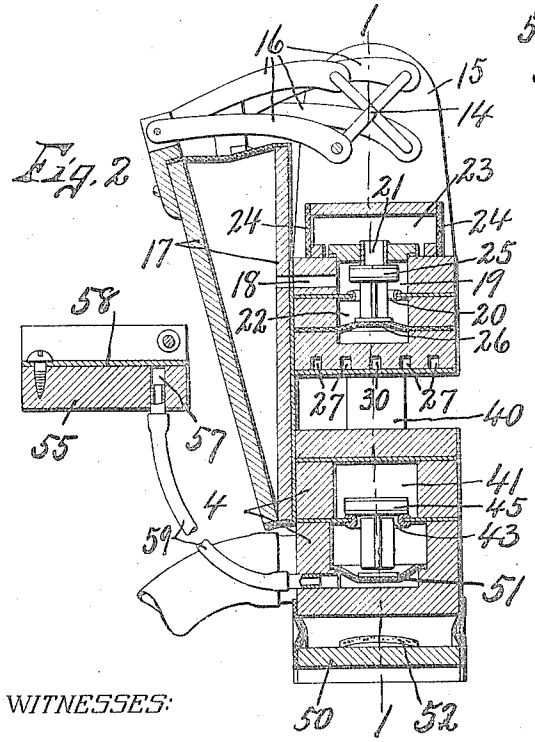
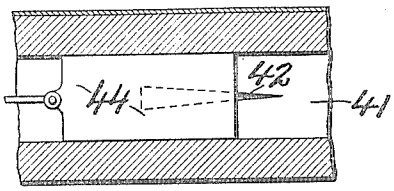


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 4.

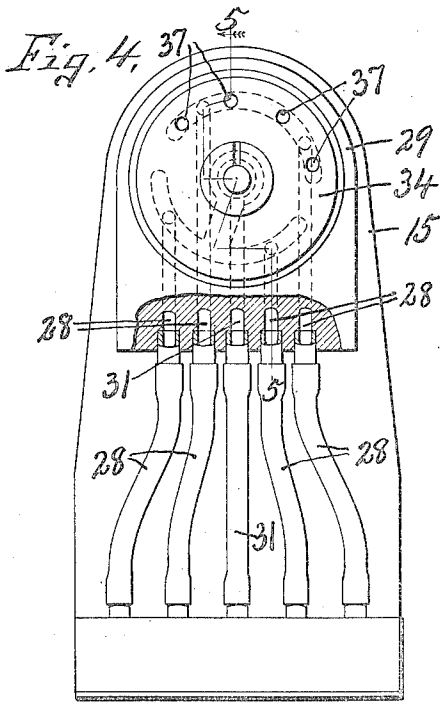


Fig. 5.

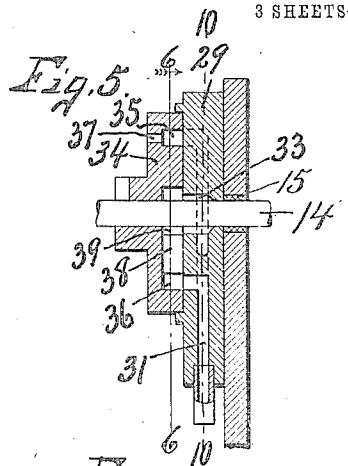


Fig. 6.

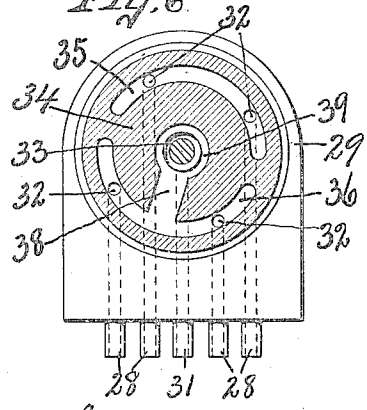


Fig. 7.

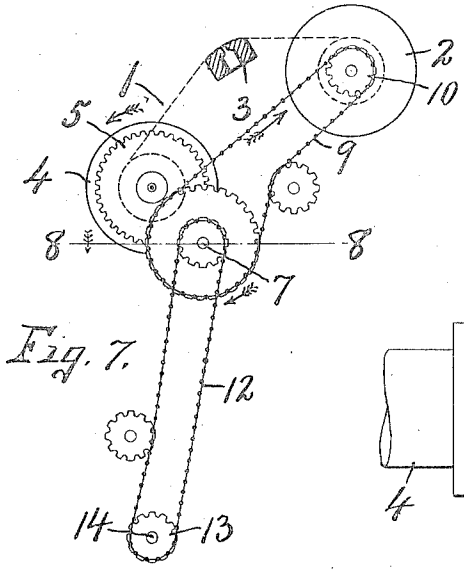
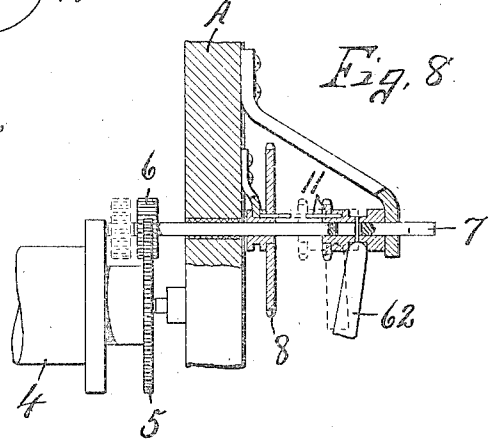


Fig. 8.



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3 SHEETS—SHEET 3.

Fig. 9.

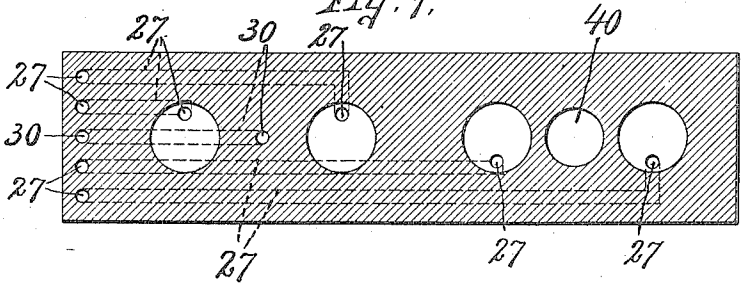


Fig. 10.

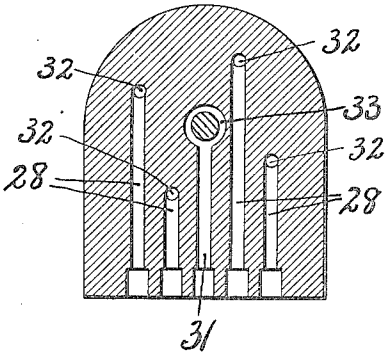
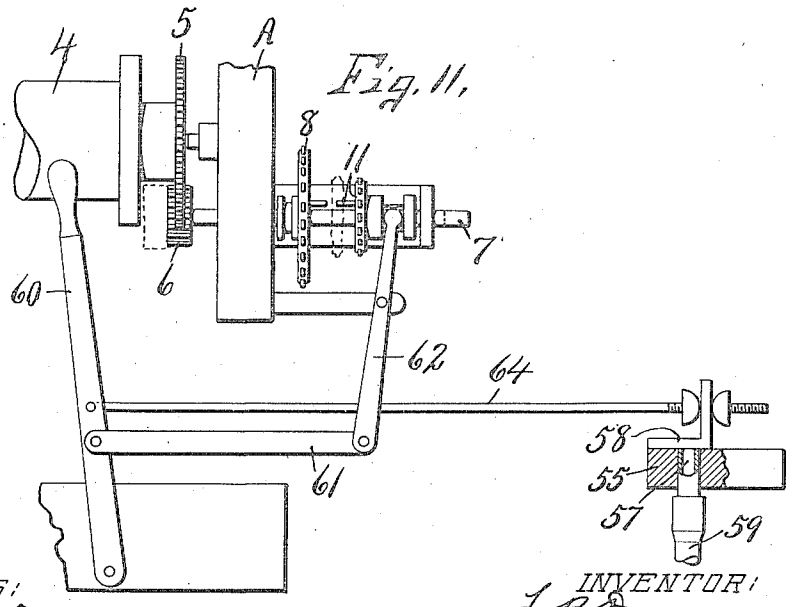


Fig. 11.



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UNITED STATES PATENT OFFICE.

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MOTOR-ACTION FOR SELF-PLAYING MUSICAL INSTRUMENTS.

1,067,215. Specification of Letters Patent. Patented July 8, 1913.

Original application filed March 19, 1905, Serial No. 249,250. Divided and this application filed September 4, 1906. Serial No. 333,214.

To all whom it may concern:

Be it known that I, LEWIS B. DOMAN, of Elbridge, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Motor-Actions for Self-Playing Musical Instruments, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in self-playing musical instruments, and refers more particularly to a pneumatic motor mechanism similar that shown in my pending application No. 249,250, filed March 9, 1905, of which this is a division.

The main object of my present invention is to simplify the controlling action for the motor pneumatics and at the same time to render the action of said pneumatics more readily responsive to slight variations in the tension of the actuating air so that the speed of action of the winding and rewinding mechanism may be instantly changed from one extreme to another, or graded to any intermediate degree to regulate the tempo.

Another object is to interpose a porous wall or partition in the connection between the motor pneumatics and atmosphere, whereby atmospheric air is caused to sift slowly and softly through such wall or partition, and thence into the motor pneumatics to prevent their impulsive or sudden vibratory action, or rather to cause a steady collapse and inflation of said pneumatics as they are alternately placed in communication with the exhaust device and atmosphere.

A further object is to control the action of the several valves and their primary pneumatics through the medium of a rotary valve which is preferably mounted upon and driven by the motor shaft.

A still further object is to interpose a governing pneumatic in the connection between the exhaust device and motor action to establish as nearly as possible a uniform tempo during the playing of a selection.

Another object is to provide manually controlled means whereby direct communication between the exhaust device and motor action is established irrespective of the governing pneumatic and simultaneously with the connection of the driving mechanism with the rewinding roller so as to actuate the rewinding mechanism with an increased speed.

Other more specific objects and uses will be brought out in the following description.

In the drawings—Figures 1 and 2 are sectional views taken respectively on line 1—1, Fig. 2, and 2—2, Fig. 1. Fig. 3 is a sectional view taken on line 3—3, Fig. 1. Figs. 4, 5, and 6 are sectional views taken respectively on lines 4—4, Fig. 1; 5—5, Fig. 4, and 6—6, Fig. 5. Fig. 7 is an end view of the mechanism for transmitting motion from the motor driving shaft to the winding and rewinding rollers. Fig. 8 is a sectional view taken on line 8—8, Fig. 7. Figs. 9 and 10 are sectional views taken respectively on lines 9—9, Fig. 1, and 10—10, Fig. 5. Fig. 11 is a front elevation of the shifting device for the driving clutch and vent valve for the motor control.

A perforated music-sheet —1— is reeled upon a suitable roller —2— which is inserted in suitable bearings in the upper end of a case —A— at the rear of a tracker —3—. The free end of the music sheet is drawn over the tracker and attached to a feeding roller —4— which is located in front of and in a plane beneath the tracker —3—.

The roller —2— from which the music-sheet is unwound, and upon which it is again re-wound is removable to permit different music-rolls to be inserted, but the winding roller —4— is permanently journaled in the case and may be provided with any suitable means to which the advance end of the music-sheet may be detachably connected so as to automatically release on the rewind.

As best seen in Fig. 7, the roller —4— is provided with a gear —5— which meshes with a pinion —6— on a shaft —7—. Loosely mounted upon the shaft is a sprocket-wheel —8— which is connected by a chain —9— to a smaller sprocket-wheel —10— on the spindle of the rewind roller —2—.

The shaft —7— is movable endwise sufficient to throw the pinion —6— out of mesh with the gear —5— and is provided with a clutch-section —11— which is secured to the shaft —7— and is adapted to interlock with a similar clutch section on the face of the sprocket —8—, whereby when the pinion

—6— is out of mesh with the gear —5— the shaft —7— is locked to and operates to rewind the music-sheet with considerably greater speed than when wound upon the roller —4— by reason of the fact that the sprocket-wheel —10— is very much smaller than the sprocket-wheel —8—.

The clutch-member —11— is preferably made in the form of a sprocket-wheel and is connected by a chain or belt —12— to a sprocket-wheel —13— on a crank-shaft —14—. This crank-shaft —14— is journaled at its ends in suitable bearings —15—15— and is provided with a series of, in this instance, four, crank-arms each being arranged a quarter of a turn in advance of the other and each crank is connected by a link —16— to the movable side of a motor pneumatic —17—. It now appears that there are four motor-pneumatics, one for each crank-arm, said pneumatics being successively brought into action in a manner hereinafter described for transmitting motion to the crank-shaft —14—.

Each motor-pneumatic is connected by a passage —18— to a valve-chamber —19— having opposite ports —20— and —21—. The port —20— connects the valve-chamber with an exhaust-chamber —22— and the port —21— opens into a chamber —23— having one or more porous side walls —24— surrounded by atmosphere. Each valve-chamber —19— contains a valve —25— which normally covers the port —20— and is operable by a primary pneumatic —26— to close the port —21— and open communication between the exhaust-chamber —22— and valve-chamber —19—, and thence, through the passage —18— to the motor-pneumatic —17—. The exhaust-chamber —22— is common to all of the primary-pneumatics —26— and their valves —25—, and therefore, is common to all of the motor-pneumatics —17—.

The primary-pneumatics and valves for controlling the motor-pneumatics are all located in a single shelf or air-chest which is provided with a series of channels —27—, each leading to one of the primary pneumatics —26—, and each channel is connected by a duct or conduit —28— to the fixed head —15— in which one end of the crank-shaft is journaled, said valve-shelf being also provided with an additional channel —30— which communicates with the exhaust-chamber —22— and is also connected by a conduit —31— to the head —15—, as best seen in Fig. —1—.

As best seen in Figs. 1, 4 and 5, and particularly in Fig. 4, the conduits —28— extend upwardly into the head —15— and terminate in ports —32—, which are arranged concentrically with the axis of revolution of the crank-shaft —14— and are spaced substantially equidistant apart circumferentially and open through one of the end faces of the head —15—, which is also provided with a substantially central port —33— opening from the same side of the head —15— as the ports —32— and communicating with the exhaust conduit —31—.

A rotary valve —34— is secured to the crank-shaft —14— to cover the open ends of the ports —32— and —33— and is provided with two substantially semi-circular grooves or channels —35— and —36— which are movable into registration with and are each of sufficient circumferential length to embrace two of the ports —32— simultaneously, the groove —35— being provided with lateral passages —37—, which open to atmosphere. The groove —36— is provided with a radial branch passage —38— which opens into an annular recess —39— surrounding the shaft —14— and communicates at all times with the central port —33— of the head —15—. The port —33—, it will be remembered is connected to the exhaust conduit —31—, otherwise the adjacent end faces of the head —29— and rotary valve —34— fit closely with each other to prevent undue leakage of air. This rotary-valve controls the operation of the primary-pneumatics —26—, which, together with their valves —25— control the operation of the motor-pneumatics —17—.

The operation of these motor-pneumatics is as follows: Assuming that the rotary-valve —34— is in the position seen in Figs. 4, 5 and 6, in which position the groove —35— is in registration with the two upper ports —32— and is, therefore, in communication with the second and fourth conduits —28—, (numbered from left to right, Fig. 4,) and also with the primary pneumatics —26— which are in communication with said conduits —28— while the other groove —36— of the valve —34— is in communication with the two lower ports —32— which are connected to the first and third conduits —28—, (numbering from left to right, Fig. 4,) and, therefore, said groove —36— is in communication with the primary-pneumatics which are connected to the two lower ports —32—. It is now clear that atmospheric air is free to enter the groove —35— through apertures —37— in the rotary valve —34— and that this atmospheric air enters through the corresponding tubes —28— to inflate their respective primary-pneumatics —26—, and thereby unseat the valves —25— from the ports —20— to establish direct communication between the vacuum chamber —22— and motor-pneumatics —17—, whereby said motor-pneumatics are deflated and cause their movable sides to rotate the crank-shaft —14— through the medium of links —16—. While this operation is taking place, the two lower ports —32— are in communication with the exhaust-chamber —22— through

the channel —30—; conduit —31—; annular chambers —33— and —39—, and radial passage —38— so that the air is being exhausted from the primary pneumatics —26— which are in communication with the lower ports —32— and their corresponding valves —25— drop by gravity aided by atmospheric pressure to close their respective ports —20—. During the collapse of the primary pneumatics —26— which allow the valves —25— to open the ports —21— the atmospheric air slowly sifts through the porous walls —24— of the chamber —23— and passes through the ports —21— and into their respective motor pneumatics —17— to slowly inflate the latter. This sluggish action of the return movement of the movable sides of the motor pneumatics is important by reason of the fact that it prevents the impulsive action or flapping of such pneumatics, and thereby removes the noise due to such impulsive action and gives a steadier action in the driving of the shaft —14—. The exhaust chamber —22— is connected by a conduit —40— to a valve chamber —41— having two valved ports —42— and —43— with which are associated valves —44— and —45—. The port —43— opens into an exhaust chamber —46—, which in turn, is connected by a conduit —47— to an exhaust device —48— and is also connected by a port —49— to the interior of a governing pneumatic —50—. This governing pneumatic embraces both of the ports —42— and —49— and forms an indirect connection between the exhaust device and motor action through the tapering port —42—, the valve —44— serving as a means for controlling the passage of air between said governing pneumatic and motor action to regulate the tempo or speed of action of the motors and winding mechanism for the music sheet. The valve —45— is normally closed, but is opened automatically by means of a primary pneumatic —51— when throwing the rewinding mechanism into action, as previously described.

The governing pneumatic —50— is provided with a porous valve —52— co-acting with the port —49— to establish a uniform air tension in the motor action during the playing of the musical selection. It is now apparent that a partial vacuum is maintained in the governing pneumatic —50— which tends to move the valve —52— into position to close the port —49—, but by reason of the porosity of the valve —52— a small amount of air is capable of sifting therethrough even when closed, and, therefore, this valve serves in a measure, to regulate the force of action of the motor pneumatics, thereby determining the speed of the music-sheet and tempo of the selection. This tempo, however, is further regulated by means of the valve —44—, which is movable across the opening —42— and is connected by a link —53— to a tempo-lever —54—, previously mentioned, so that by rocking this lever in one direction or the other the passage —42— may be more or less restricted, thereby controlling the force of action of the motor pneumatics and speed of the music-sheet when playing a musical selection.

The object of the port —43; valve —45—, and primary pneumatic —51— is to establish direct communication between the main exhausting device and motor pneumatics for operating the latter with full force and with increased speed in the rewinding of the music-sheet from the roll —4— to the roll —2—. During this operation, it is desirable to cut off communication between the main exhausting device and key-action, and for this purpose I provide a valve-shelf —55— with a port —57— which is normally covered by a valve —58—, but when uncovered, is open to the atmosphere. This port —57— is connected by a flexible conduit —59— to the primary pneumatic —51—. It is now clear that by swinging the valve —58— to uncover the port —57—, atmospheric air is admitted to the pneumatic —51— through the tube —59—, thereby causing the inflation of said pneumatic, and operation of valve —45— to uncover the port —43—. This opening of the valve —45— establishes direct communication between the exhaust device —48— and exhaust-chamber —22— of the motor action, thereby practically cutting out the governing pneumatic —50—.

The operation of the valve —58— to open the port —57— to the atmosphere is preferably accomplished simultaneously with the shifting of the clutch-section —11— into engagement with the gear —8— of the music-sheet driving mechanism for rewinding the music-sheet upon the roll —2—, and for this purpose I provide a hand-lever —60— within convenient reaching distance of the operator and connect this hand-lever by a link —61— and lever —62— to the clutch section —11—, whereby when the lever —60— is moved in one direction the shaft —7— is moved endwise to disengage the pinion —6— from the gear —5—, and at the same time to force the clutch —11 into driving connection with the sprocket-wheel —8—. The lever —60— is also connected by a link —64— to the free end of the swinging valve —58— so that when the lever —60— is rocked to throw the driving mechanism into connection with the rewinding roll —2— the port —57— is simultaneously uncovered to admit atmospheric air to the pneumatic —51— for the purpose previously described.

The operation of my invention is as follows: The main exhausting device is actuated in any well known manner to maintain a partial vacuum in the tempo govern-

ing pneumatic —50— and exhaust chamber —22— of the motor-pneumatic controlling mechanism. In the relative arrangement of the cranks of the shaft —14—, at least one of the motor pneumatics —17— is expanded or inflated and its corresponding primary pneumatic —26— is therefore, deflated to allow its valve —25— to close its port —20— so that when each primary pneumatic is opened to atmosphere through the ports —37— of the rotary valve —34 atmospheric air immediately enters such primary pneumatic —26—, thereby inflating it and elevating its valve —25— to connect the exhaust-chamber —22— with the corresponding motor pneumatic —17— through the passage —18—, thus causing the collapse or deflation of the motor pneumatic —17— and consequent rotation of the crank-shaft —14— which is connected in the manner previously described to wind the music-sheet upon the roller —4—, the speed of action being controlled by the tempo-lever —54— and valve —44—. In rewinding the music-sheet the lever —60— is operated in the manner previously described, to disconnect the driving shaft —7— from the roller —4—, and at the same time to connect it to the rewinding roller —2—. During this operation, the valve —58— is operated to uncover the port —57—, thereby admitting atmospheric air to the pneumatic —51, Fig. 2, and establishing direct communication between the main exhaust device and vacuum chamber —22— of the motor pneumatics and throwing the full force of the exhausting device into the motor pneumatics to increase the speed of action on the rewind of the music-sheet.

It will be observed that the rotary valve —34— operates to admit and to shut off atmospheric air to and from the pneumatics —26—, the admission of air causing the valve, as —25—, to rise and the corresponding motor pneumatic —17— to be collapsed. This rotary valve is so designed that each valve —25— is forced against its upper seat during approximately one-half of one revolution of the motor crank-shaft, and that immediately thereafter the air in the pneumatic —26— is exhausted, which, together with the atmospheric pressure on the valve causes the valve to open the port —21— and to close the port —20—, thereby cutting off communication between the exhaust chamber —22— and the pneumatic —26— and at the same time establishing communication between the chamber —23— and said pneumatic. It is now apparent that each motor-valve-operating-pneumatic is alternately placed in communication; first, with the atmosphere, and then with the exhaust, and that the usual bleed holes, which cause a loss of energy, are avoided, and that all of the operating air is available to elevate the valve, while on the other hand, after the atmospheric air is cut off by the partition between the passages —35— and —36— the whole area of the conduit —31— is available for the exhaust to collapse the diaphragm.

What I claim is:

1. In a pneumatic motor action for self-playing instruments, an exhaust device, a tempo-governing pneumatic in direct connection with the exhaust device, a valve chest having an exhaust chamber in direct communication with the tempo-governing pneumatic and also provided with a series of valve chambers and ports connecting them with the exhaust chamber, the valve chambers having atmosphere ports, motor pneumatics communicating with their respective valve chambers, valves for said ports, primary actuating pneumatics for the valves, a separate valve case having a port in constant communication with the exhaust chamber and provided with additional ports connected to their respective primary pneumatics and a rotary valve actuated by the motor pneumatics for successively connecting said additional ports to the exhaust port.

2. In a motor action for self-playing musical instruments an exhaust device, a valve chest having an exhaust chamber in communication with the exhaust device, said valve chest being provided with a series of valve chambers and having one set of ports connecting them to the exhaust chamber and another set of ports alined therewith and communicating with the atmosphere, valves for said ports, pneumatic actuators for the valves, motor pneumatics communicating with their respective valve chambers, a rotary shaft actuated by the motor pneumatics and means including a rotary valve actuated by the shaft for alternately placing the pneumatic actuators in communication with the exhaust chamber with the atmosphere.

3. In a pneumatic motor action for self-playing musical instruments, an air chamber having a porous wall exposed to the atmosphere and through which the atmosphere may slowly sift, a motor pneumatic communicating with said chamber, and means for opening and closing such communication.

4. In a pneumatic action for self-playing musical instruments, a pneumatic adapted to be alternately placed in communication with an exhaust chamber and the atmosphere, a valve for controlling such communication and a porous partition between said pneumatic and the atmosphere through which the air may sift to inflate the pneumatic, in combination with an exhaust device, and means for controlling the action of the valve.

5. In a pneumatic action for self-playing musical instruments, a pneumatic motor ac-

tion comprising a valve-chest inclosing a group of valves and their primary pneumatics, an exhaust-device communicating with the valve chest, an air chamber also communicating with the valve chest and having its sides porous and exposed to the atmosphere to allow air to sift therethrough into the valve chest, motor pneumatics communicating with said valve chest, and means actuated by the motor pneumatics for controlling the operation of the primary pneumatics.

6. In a pneumatic motor action for self-playing musical instruments, an exhaust chamber and a valve chamber having an atmosphere port and an additional port connected to the exhaust chamber, a valve for alternately opening and closing said ports, actuating means for the valve comprising a primary pneumatic forming a part of one side of the exhaust chamber, a port connected to the exhaust chamber around the primary pneumatic, an additional port connected to the primary pneumatic, a rotary valve having means for connecting the last named ports to each other and for placing such ports in communication with the atmosphere, a motor pneumatic communicating with said valve chamber whereby said motor pneumatic is alternately placed in communication with the exhaust chamber and with the atmosphere, and means actuated by the motor pneumatic for operating the rotary valve.

In witness whereof I have hereunto set my hand this 31st day of August 1906.

LEWIS B. DOMAN.

Witnesses:
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M. ELLIOTT.