L. B. DOMAN.

MOTOR ACTION FOR SELF PLAYING MUSICAL INSTRUMENTS.

APPLICATION FILED SEPT. 26, 1906.

900,496. Patented Oct. 6, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

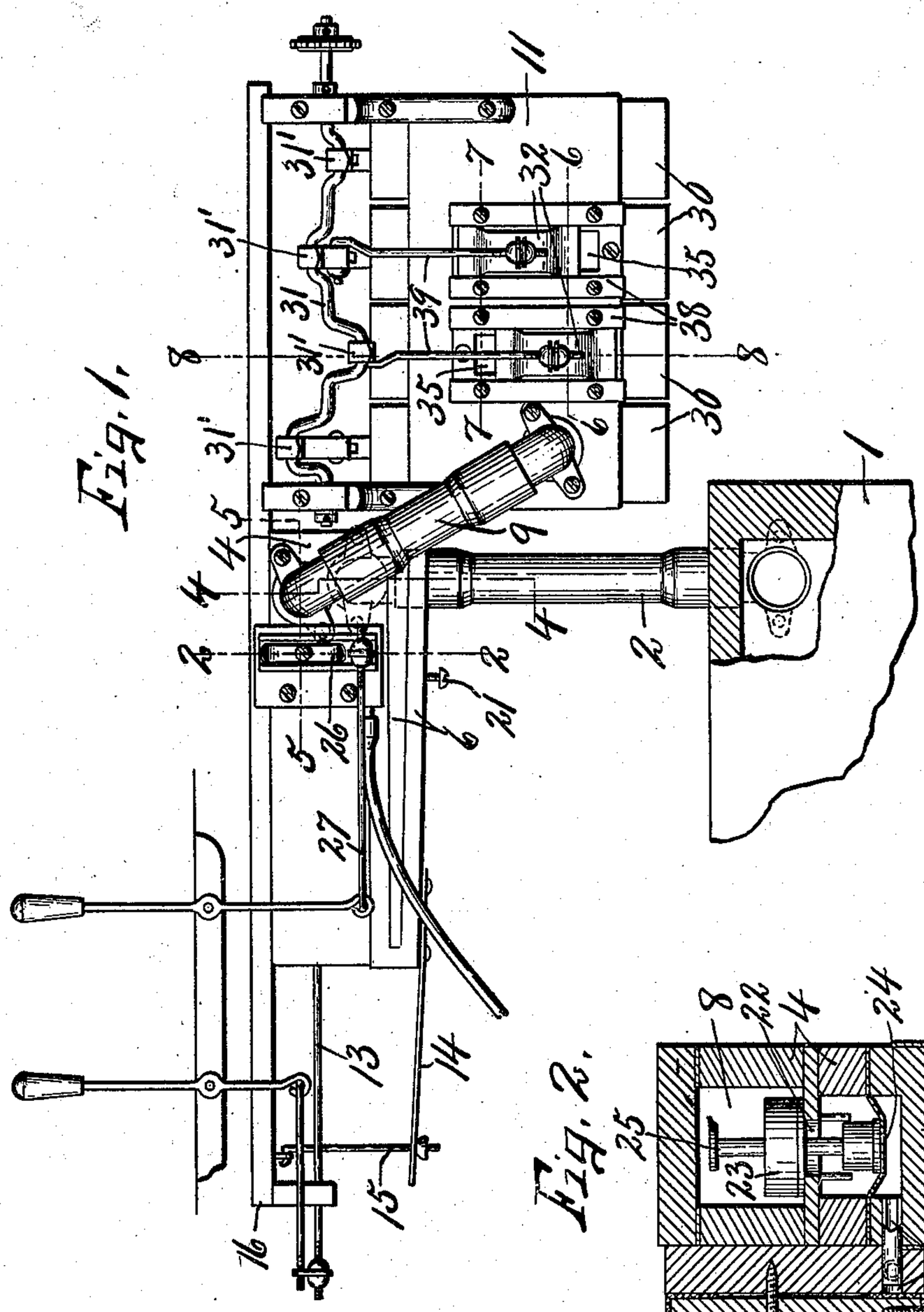
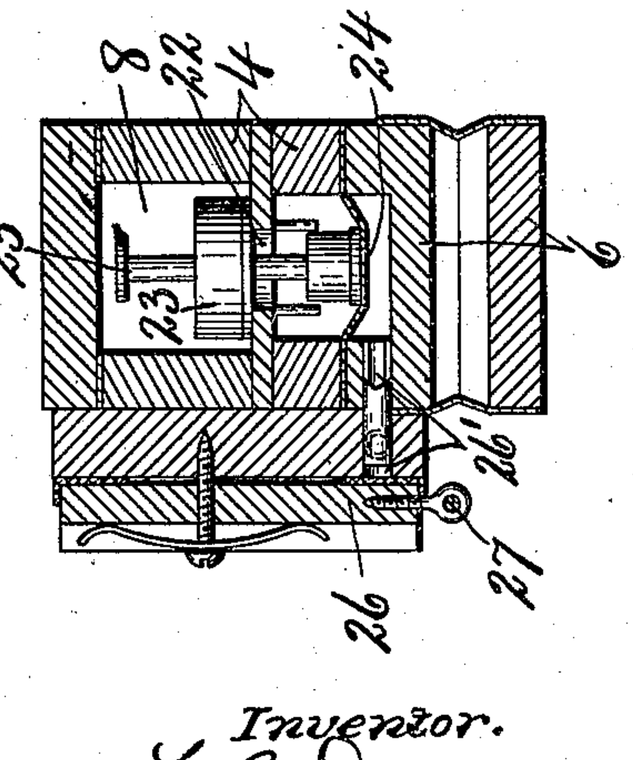


Fig. 2.



Witnesses.

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2 SHEETS—SHEET 2.

Fig. 3.

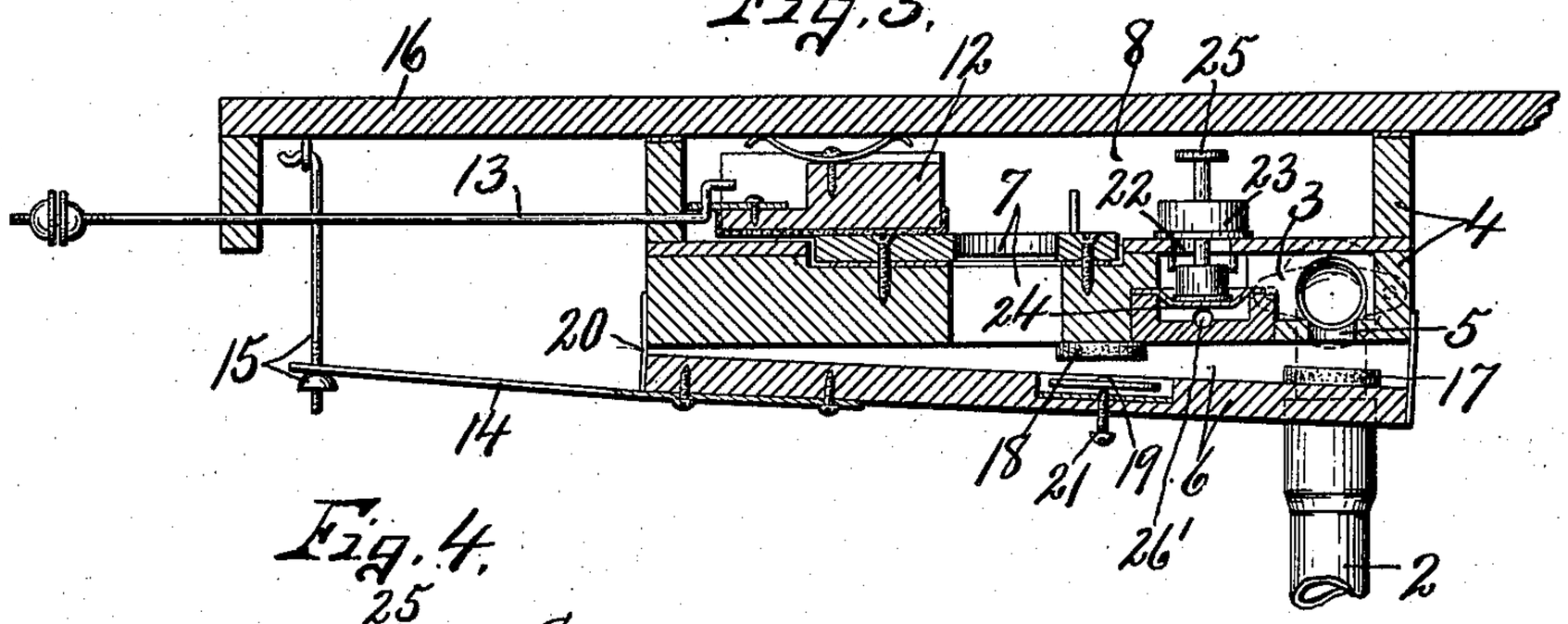


Fig. 4.

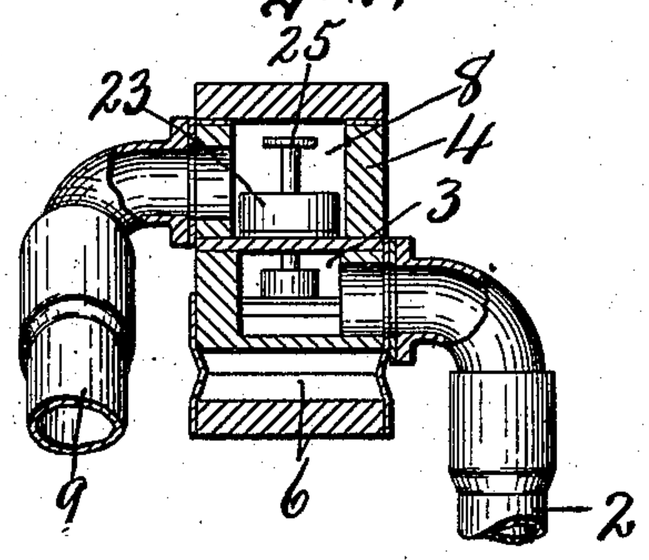


Fig. 5.

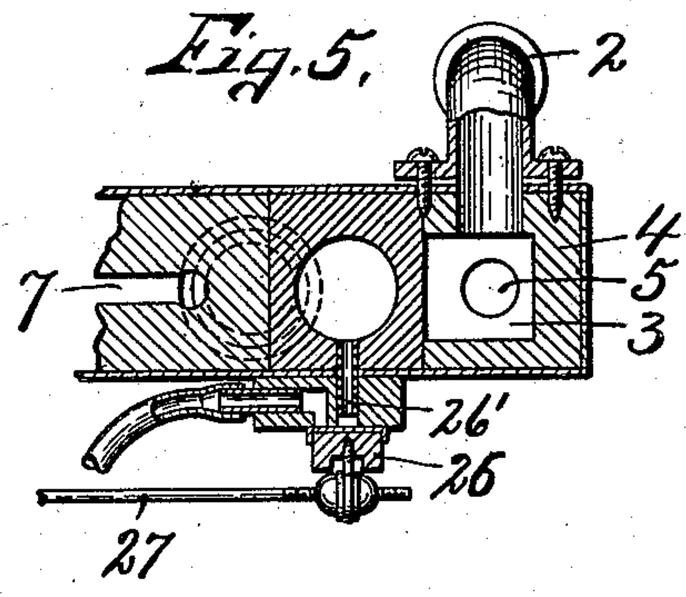


Fig. 6.

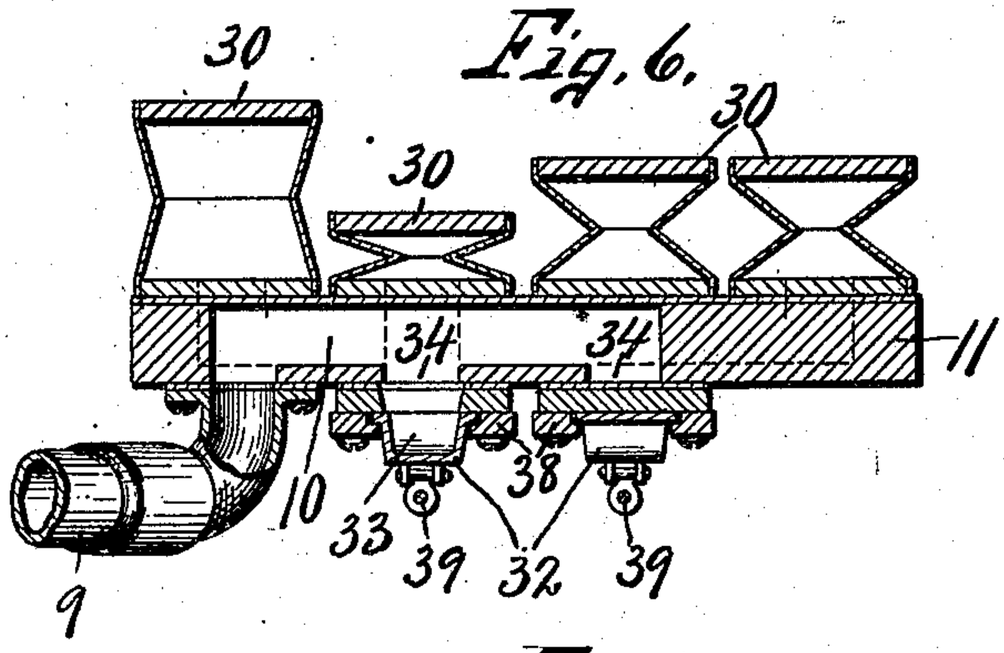
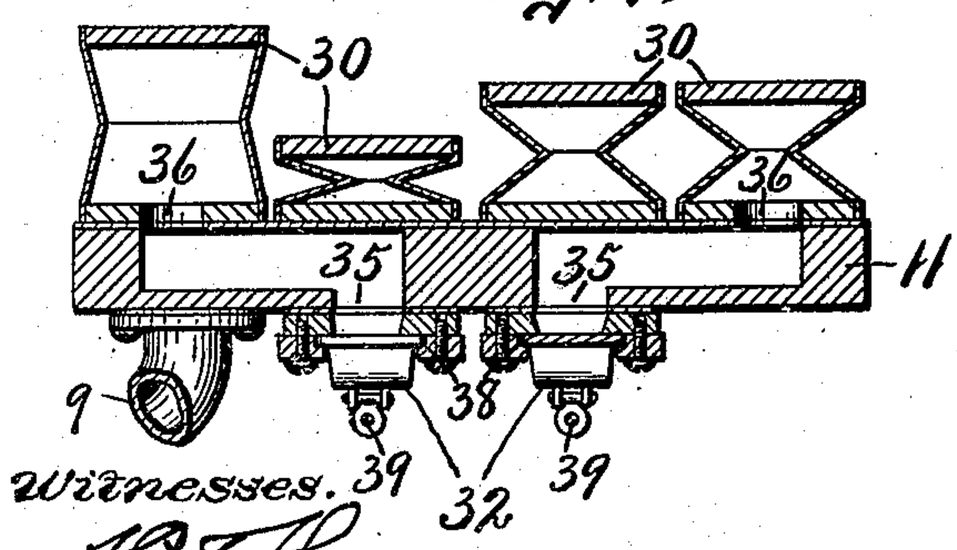


Fig. 7.



Witnesses.

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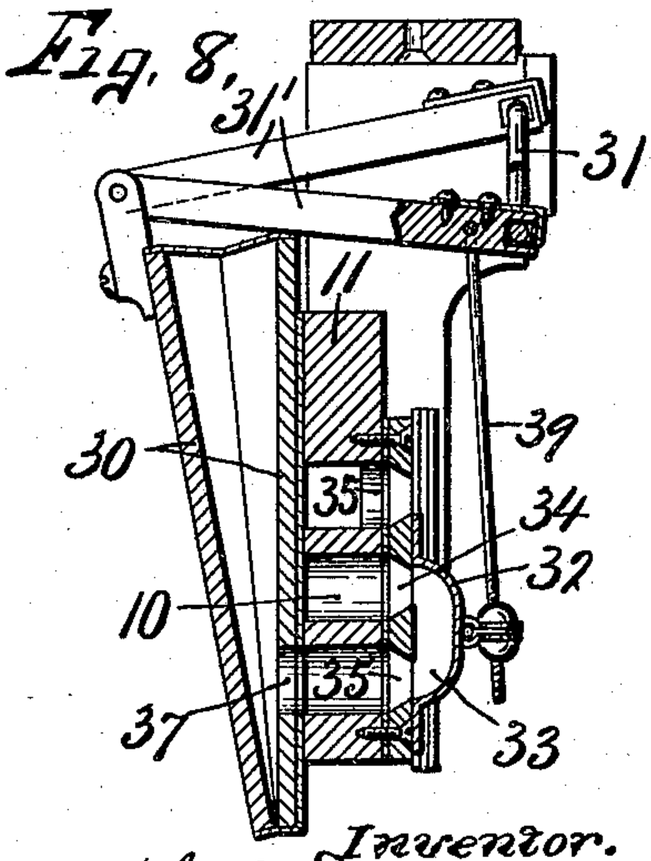
H. E. Chase

Fig. 8.



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UNITED STATES PATENT OFFICE.

LEWIS B. DOMAN, OF ELBRIDGE, NEW YORK, ASSIGNOR TO AMPHION PIANO PLAYER COMPANY, OF ELBRIDGE, NEW YORK, A CORPORATION OF NEW YORK.

MOTOR-ACTION FOR SELF-PLAYING MUSICAL INSTRUMENTS.

No. 900,496. Specification of Letters Patent. Patented Oct. 6, 1908.

Original application filed August 8, 1906, Serial No. 329,692. Divided and this application filed September 26, 1906. Serial No. 336,339.

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 pneumatic motor action and its governing mechanism for self-playing musical instruments of the class set forth in my pending application No. 329,692, filed August 8, 1906, of which my present application is a division. In this class of devices a minus pressure or partial vacuum is maintained by a suitable exhausting device in certain parts of the motor action, and the operation of the motor pneumatics is dependent upon means for alternately placing them in communication with the exhaust device and atmosphere, said motor pneumatics being connected to a suitable driving shaft for transmitting rotary motion thereto from which motion may be transmitted to any mechanism which it may be desired to operate, such for instance, as the music-sheet operating mechanism, not necessary to herein illustrate or describe as the winding and rewinding mechanism for the music-sheet forms no part of my present invention.

My object is to produce a simple, practical and highly efficient motor action and its controlling mechanism as a single article of manufacture adapted to be installed within the case of a piano or similar instrument to be used as one of the mechanical units of what is commonly known as an "inside player," without altering or unnecessarily mutilating the case of the instrument, and for this purpose it is adapted to be attached by flexible connections to such other parts of the player with which it is to communicate so that it may be adjusted more or less without liability of straining or opening any of the joints or connecting parts.

One of the more specific objects is to control the operation of a plurality of motor pneumatics with a less number of valves than has heretofore been employed as it is customary to use one valve for each pneumatic, whereas, in my present invention I have sought to control a plurality of pneumatics with a single valve.

Another specific object is to provide a simple and practical means for controlling at will, the speed of the motor from maximum to minimum, and vice versa, so that when used in connection with the winding and rewinding mechanism for the music-sheet the tempo may be regulated to a nicety, or, full force of exhausting pneumatics may be thrown into the motor action to actuate the same with a maximum speed during the rewinding of the music-sheet.

A further object is to provide means for cutting out the tempo controlling pneumatic when it is desired to operate the motor pneumatics with increasing speed.

Other objects relating to the specific structure of the various parts and its controlling mechanism will be brought out in the following description.

In the drawings—Figure 1 is a front elevation of my improved motor action and its controlling means. Fig. 2 is a sectional view taken on line 2—2, Fig. 1. Fig. 3 is an enlarged vertical sectional view through the controlling mechanism for the motor action. Figs. 4, 5, 6, 7 and 8 are sectional views taken respectively on lines 4—4, 5—5, 6—6, 7—7, and 8—8, Fig. 1.

The exhaust-device, as —1—, is connected by a flexible conduit —2— to a valve chamber —3— of a valve-chest —4— constituting a part of the controlling mechanism for the motor action. The valve-chamber —3— is in permanent communication through a port —5— with a tempo governing pneumatic —6—, which in turn, is connected by a valved port —7— with a second valve chamber —8— also within the valve-chest —4—. The governing pneumatic —6— therefore embraces both of the ports —5— and —7— and forms a part of the connection between the wind-inducing device and valve chamber —8—, which latter is connected by a flexible conduit —9— to an exhaust-chamber —10— of a second wind-chest —11— of the motor action presently described.

A slide valve —12— is operable manually

through the medium of an actuating rod —13— across the inner end of the port —7— to vary the volume, and incidentally the power of the actuating air passing therethrough from the exhaust-chamber —10— of the motor action.

The governing pneumatic —6— is distended through the medium of a spring —14— attached at one end to its movable side and having its other end adjustably connected by a screw and nut —15— to an extension, as —16—, of the valve-chest —4—. This governing pneumatic —6—, together with the ports —5— and —7— form an indirect passage or connection between the valve chamber —3— and valve chamber —8—, which latter is connected directly to the exhaust chamber —10— of the motor action. This indirect passage is always more or less open, the degree of opening being regulated by the valve —12— moving across the port —7—, which in turn, regulates in a measure the action of the pneumatic —6— against the tension of the spring —14—. The movable side of this governing pneumatic is provided with a porous valve —17— co-acting with the port —5— to further regulate communication between the valve chamber —3— and port —7— in the following manner: When the valve 12— is full-open, as shown in Fig. 3, the force of the air tension in the chamber —10— is at its maximum, although any excess of tension which may be produced by the wind-inducing device will tend to collapse the governing pneumatic —6— against the action of its spring —14—, which in turn, will cause the porous valve —17— to partially close the port —5— to temporarily subdue the force of the increased tension in the motor action, or until normal tension is restored by the spring —14— reacting to distend the pneumatic —6— to its normal position. The adjustment of the spring —14—, therefore, determines the degree of pressure or air force necessary to collapse the pneumatic —6— to partially close the valve —17—, but it is evident that the same effect may be produced by partially closing the valve —12—, which reduces the force of the actuating air in the valve chamber —8— and exhaust-chamber —10—, while at the same time the full air tension from the exhaust device is thrown into the governing pneumatic tending to collapse the same against the action of the spring —14— and to automatically move the valve —17— to the port —5— to partially cut off communication between said exhaust device and governing pneumatic, thereby further subduing the force of air passing through the port —7—.

The degree of vacuum in the system is, of course, variable and would be sufficient at times to completely collapse the governing pneumatic —6— against the action of its retracting spring, which would cause the valve —17— to more positively close the port —5—. This, of course, would be objectionable and in order to obviate such conditions I interpose additional resistance by providing the movable side of the governing pneumatic —6— with an auxiliary fulcrum bearing —18— and adjustable fulcrum —19— some distance from the hinge, as —20—, of said movable side of the pneumatic —6—, the fulcrum —19— being adjustable by means of a screw —21—.

The bearing —18— is secured to the fixed side of and within the pneumatic —6— between the ports —5— and —7— and the fulcrum —19— and its adjusting screw —21— are mounted upon the movable side of said pneumatic substantially midway between its ends and adapted to engage the bearing —18— just before the valve —17— closes the port —5—, thereby shifting the fulcrum farther from the resistance offered by the connection of the spring —14— with the rod —15—, and correspondingly increasing the resistance to the closing of the valve or collapse of the pneumatic —6— there being a slight play of the hinged end of the pneumatic —6— to permit this shifting of the fulcrum. This assures an open, though constricted communication between the ports —5— and —7—, or rather between the exhaust device and motor action through the governing pneumatic and enables the speed of action of the motors to be more closely regulated.

I have now described the tempo controlling mechanism during the playing of the musical selection, but it is sometimes necessary to operate the motor pneumatics with an increased speed requiring the full force or tension of the exhausting device, as for instance, in the rewinding of the music-sheet, and for this purpose I provide the partition between the chambers —3— and —8— with a connecting port —22— having associated therewith, a valve —23— adapted to be operated by the primary pneumatic —24— also within the valve-chest —4—.

The valve —22— opens into the valve chamber —8— and is provided with a stop —25— for engaging the upper side of the chamber —8— and limiting the opening movement of the valve —22—, the object of which is to control direct communication between the chambers —3— and —8— and to establish direct communication between the wind-inducing device and motor action. This valve —22— is opened by the inflation of the pneumatic —24—, which latter operation is controlled at will through the medium of the valve —26— and port —26′— that leads from the pneumatic —24— to atmosphere so that when the valve —26—,

which is operated manually through the medium of a rod —27—, is opened to uncover the port —26′— atmospheric air is admitted to and operates to inflate the pneumatic —24—, thereby opening the valve —23— from its port —22— and establishing direct communication between the valve chambers —3— and —8—.

The valve —22— remains open as long as the port —26′— is opened to atmosphere and as soon as it is closed indirect communication is reëstablished through the governing pneumatic —6— between the wind-inducing device and motor action.

It is now evident that the exhaust chamber —10— of the motor action is in permanent communication with the exhaust device through the conduit —9— and wind-chest —4— of the controlling mechanism and that the air tension in said chamber —10— is governed by the position of the pneumatic —6— and valve —23— and that by connecting a series of motor pneumatics, as —30—, with the exhaust-chamber —10—, these pneumatics will be operated with a force and speed corresponding to the degree of minus pressure maintained in the chamber —10—.

One of the distinctive features of this motor action is that a plurality of, in this instance two, motor pneumatics —30— are alternately placed in communication with the exhaust chamber —10— and with atmosphere through the medium of a single valve, as —32—, of which there are two each controlling the action of a pair of pneumatics —30—, and for this purpose I provide each valve —32— with a chamber or channel —33— and also provide the chamber —10— with a pair of separate ports —34— each communicating with its valve chamber —33—.

Associated with each of the ports —34— is a pair of ports —35— arranged in vertical alinement with but at opposite sides of the exhaust-port —34—, the upper ports of each pair communicating through separate passages —36— with the end pneumatics —30— while the lower ports —35— communicate through separate passages —37— with the two intermediate pneumatics —30—. These valves are reciprocated back and forth in suitable guides —38— by means of rods —39— which are attached at one end to the valves and have their upper ends attached to the intermediate links —31—.

The area of each valve is sufficient to cover all three of the ports with which it is registered, but this chamber —33— is only of sufficient area to embrace two adjacent ports, that is, the middle exhaust port —34— and one or the other of the valve ports —35— which open to atmosphere when uncovered by the valve —32—.

The vertical movement of the valve —32— is substantially equal to the compound vertical widths of the lower and upper ports —35— and the chambers —33— of said valves are therefore, always in communication with the exhaust device through the ports —34— and chamber —10—, and when each valve is removed to its extreme up or down position, it embraces the exhaust port —34— and one of the ports —35— while the other port —35— is open to atmosphere, thereby causing the exhaust and deflation of one of the pneumatics —30— while the other is being inflated by the atmosphere. Each valve, therefore, controls a pair of adjacent pneumatics, as in this instance, one intermediate and one end pneumatic and the crank-arms of the shaft —31— for each pair of pneumatics are offset the same distance at diametrically opposite sides of the axis of said shaft, the crank arms of one pair being disposed in a plane at substantially right angles to that of the other pair so that those to which the two intermediate pneumatics are connected are arranged a quarter turn, one in advance of the other, and the alternate crank-arms are also arranged a quarter turn one in advance of the other, thereby preventing any possibility of a "dead-center" lock, and assuring the starting of the crank-shaft by the motors from any stopping position.

The valve rods —39— are attached to the two intermediate links —31′— a short distance inwardly from the crank-arms to give the desired vertical movement to the valves so that when one of these crank-arms and its corresponding valve are in their extreme lower positions, as shown in Fig. 8, to connect the lower port with the exhaust device, leaving the upper port open to atmosphere, the pneumatic connected to the lower port is being deflated, while that connected to the upper port is being inflated, during which time the other valve is covering the upper and lower ports so that during the next quarter turn of the crank-shaft the first named valve is moved to close both of its upper and lower ports, and on the next quarter turn connects the upper port and its corresponding pneumatic to the exhaust device and opens the lower port and its corresponding pneumatic to atmosphere, and on the third quarter-turn, again closes both the upper and lower ports, and on the last quarter, returns said valve to the starting position. This action is the same for both valves except that one of the valves is a quarter turn of its movement in advance of the other. It therefore, follows that in one position of the crank-shaft the two upper ports and their corresponding pneumatics are open to atmosphere while the two lower ports and their corresponding pneumatics are placed in com-

munication with the exhaust device and that when the crank-shaft is moved a half revolution the two lower ports and their corresponding pneumatics are open to atmosphere, while the two upper ports and their corresponding pneumatics are connected to the exhaust device. This association of two atmospheric ports for two pneumatics with a single exhaust port enables me to control a plurality of pneumatics with a single valve and at the same time to obtain a steady action of the crank-shaft without the liability of "dead-center" lock.

The operation of my invention will now be readily understood upon reference to the foregoing description and the accompanying drawings, and it will be observed that the motor action proper and its controlling mechanism are built together as a single mechanical unit to facilitate its installation in the case of a piano or similar instrument without alteration or unnecessary mutilation of such case, and in order that the operation may be complete, I have shown the valve rods —13— and —27— as connected to suitable hand levers shown in Fig. 1, whereby the motor mechanism may be easily controlled at the will of the operator.

What I claim is:

1. In a motor action for self-playing musical instruments, a wind chest having exhaust ports and atmosphere ports, motor pneumatics communicating with the atmosphere ports, means actuated by the motor pneumatics for opening and closing the atmosphere ports and alternately connecting them with the exhaust port, an exhaust device, a governor pneumatic forming a part of a connection between the exhaust device and exhaust port of the wind chest and provided with a valve for partially cutting off communication as the air tension increases, and pneumatic means for establishing direct communication between the exhaust device and wind chest outside of the governor pneumatic.

2. In a motor action for self-playing musical instruments, a pneumatic motor including a wind chest, an exhaust device, connections between the exhaust device and wind chest including a governor pneumatic forming a part of such connection, and a valve mounted directly upon the movable side of the governing pneumatic for reducing the air tension in the motor as the air tension in the pneumatic increases and means including a primary pneumatic for establishing direct communication between the exhaust device and said wind chest outside of the governor pneumatic.

3. In a motor action for self-playing musical instruments, a pneumatic motor including a wind chest, an exhaust device, connections between the exhaust device and wind chest including a governor pneumatic for regulating the air tension in the motor, said governor pneumatic forming a part of the connection between the exhaust device, and pneumatic means for establishing direct communication between the exhaust device and wind chest, outside of the governor pneumatic.

4. In a motor action for self-playing musical instrument, an exhaust device, a pneumatic motor including a wind chest, a governor pneumatic for regulating the air tension in the wind chest, a valve chamber communicating with the governor pneumatic and connected directly to the wind chest, a valve controlling communication between the valve chamber and governing pneumatic, an exhaust chamber connected to the exhaust device and communicating with said governor pneumatic, a valved port connecting the valve chamber with said exhaust chamber, a self-closing valve for said port, and pneumatic means for opening said valve to establish direct communication between the exhaust device and wind chest outside of the governor pneumatic.

5. A motor action for self-playing musical instruments comprising an exhaust device, a wind-chest having an exhaust port and atmosphere ports, the exhaust port communicating with the exhaust device, pneumatics each connected to one of the atmosphere ports, a valve covering the exhaust port and alternately connecting the atmosphere port thereto, means actuated by the motor pneumatics for actuating said valve, a governing pneumatic in and forming a part of the connection between the exhaust device and exhaust port, and pneumatically operated means for establishing direct communication between the exhaust device and wind chest.

6. In a motor action for self-playing musical instruments, an exhaust device, a wind-chest having atmosphere ports and an intermediate exhaust port, the latter communicating with the exhaust device, motor pneumatics, each communicating with one of the atmosphere ports, a valve and actuating means therefor coacting with said ports to control the action of the motor pneumatics, a governing pneumatic in the connection between the exhaust device and wind-chest, a valve actuated by said governing pneumatic to regulate the air tension in the wind-chest, a valve chamber communicating with the governing pneumatic and provided with a port having direct communication with the exhaust device outside of said governing pneumatic, said valve chamber forming a part of the connection between the exhaust device and wind-chest, a valve normally closing the last named port, a primary pneumatic for operating the last named valve, said primary pneumatic having a port

adapted to be opened to atmosphere, and an additional valve for the last named port whereby when open the primary pneumatic is actuated by the inflowing atmospheric air to open the second named valve and thereby establish direct communication between the exhaust device and wind-chest.

In witness whereof I have hereunto set my hand this 21 day of September 1906.

LEWIS B. DOMAN.

Witnesses:
FRED C. CARPENTER,
M. E. ELLIOTT.