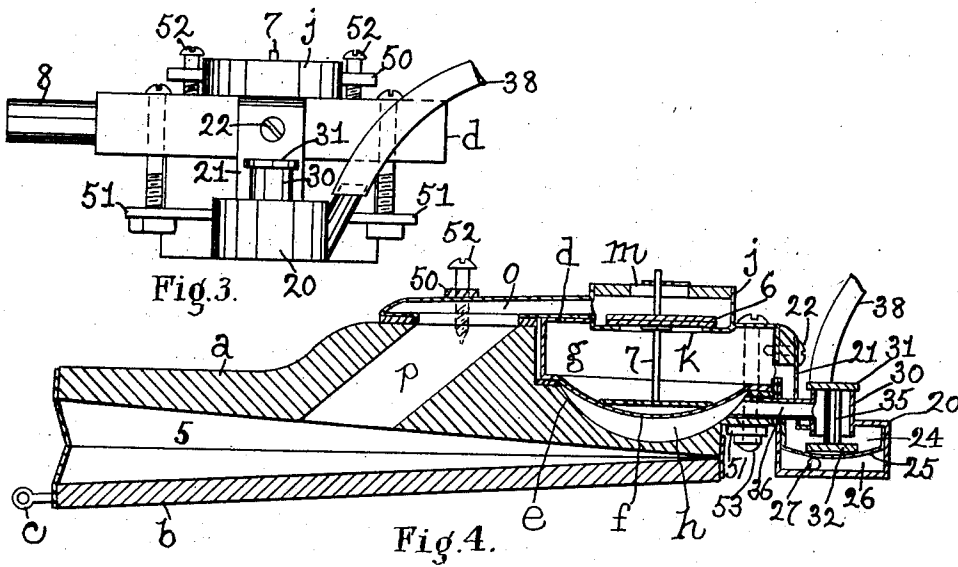
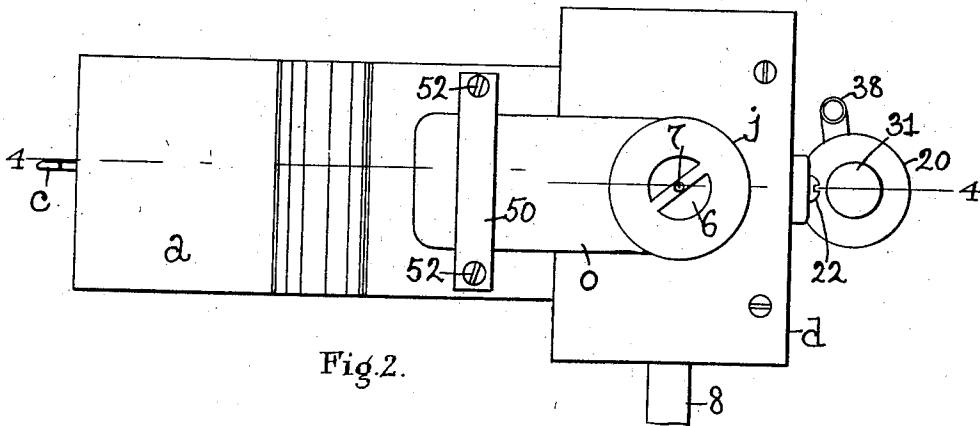
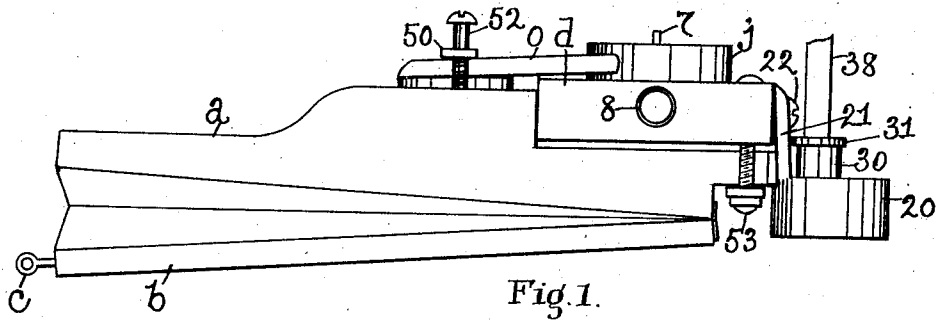


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PNEUMATIC MOTOR APPARATUS.
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Patented Oct. 24, 1911.



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JONAS VANDIN, OF SOMERVILLE, MASSACHUSETTS.

PNEUMATIC-MOTOR APPARATUS.

1,006,810.

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To all whom it may concern:

Be it known that I, JONAS VANDIN, a citizen of the United States, residing in Somerville, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Pneumatic-Motor Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to a pneumatic motor apparatus, applicable among other uses for operating musical instruments of the class commonly called piano-players.

The invention has for its object to provide a compact, simple and efficient motor apparatus of the class described. To this end, the motor apparatus as herein shown consists essentially of a bellows having its air chamber normally connected with the atmosphere and adapted to be connected with an exhaust chamber in a casing or box provided with a diaphragm which forms two chambers, one of which is designed to be permanently connected with the exhaust apparatus, and the other of which is normally connected with the exhaust apparatus but is adapted to be connected with the atmosphere through a port in a valve casing provided with a diaphragm forming chambers, one of which normally communicates with both chambers of the first-mentioned casing and the other of which is adapted to be connected with the atmosphere. The diaphragms referred to control the operation of valves in said casings, whereby the admission of air into the second casing cuts off communication between the chambers of the first casing and connects one of said chambers with the atmosphere, so that the diaphragm in the first casing is moved to cut off the bellows from the atmosphere and to connect the said bellows with the exhaust apparatus, thereby closing the bellows and effecting movement of a part or device connected with it. These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is a side elevation of a pneumatic motor apparatus embodying this invention. Fig. 2, a plan of the apparatus shown in Fig. 1. Fig. 3, an end elevation looking at the left in Fig. 1, and Fig. 4, a longitudinal section on the line 4-4, Fig. 2.

Referring to the drawings, *a* represents a

bellows, having the movable portion or member *b* hinged at its rear end to the upper or stationary portion, and provided at its front end with a device shown as a screw eye *c* for attachment of the bellows with the device or part to be operated and not herein shown. The bellows *a* has secured to it near its rear end a casing or box *d*, which will be hereinafter designated the main box or casing and which is herein shown as set into a recess or depressed portion *e* of the bellows, and is provided with a diaphragm *f*, which forms with the upper part of the box or casing *d* a chamber *g*, and with the bottom of the recess *e*, a chamber *h* which may be designated the upper and lower chambers. The box or casing *d* has secured to or forming part of its top a valve chest *j*, provided with a port *k* in its bottom leading to the chamber *g* and having in its top a port *m* leading to the atmosphere. The valve chest *j* is further provided with a duct or pipe *o*, which communicates with a passage *p* in the upper part of the bellows and leading to the chamber *h* thereof. The valve chest *j* contains within it a valve 6, herein shown as a disk valve, which is fast on a stem or rod 7 attached at its lower end to the diaphragm *f*. The valve 6 in the present instance coöperates alternately with the ports *k*, *m*. The chamber *g* is provided with an outlet pipe 8, which in practice will be connected with any desired or suitable exhaust apparatus (not shown) for producing a vacuum in the said chamber.

The diaphragm *f* separates the chambers *g*, *h*, and provision is made for connecting said chambers under normal conditions, which is effected as herein shown by an auxiliary box or casing 20, which is herein shown as provided with a hollow upright, pipe or duct 21, fastened as by a screw 22 to the rear wall of the main box or casing *d*, the said duct connecting the exhaust chamber *g* directly with a chamber 24 formed in the upper part of the box or casing 20 by a diaphragm 25 within said box, said diaphragm also forming a chamber 26 within the box 20, having an air inlet port 27 (see Fig. 4).

The box or casing 20 has attached to its top a tube 30 open at its opposite ends and forming a valve chamber, with which coöperate two valves 31, 32 attached to a stem or rod 33, the valve 31 coöperating with the upper end of the tube 30 to close it to the atmos-

phere, and the valve 32 cooperating with the lower end of the said tube to close it to chamber 24. The tube or valve chamber 30 is connected by a pipe 36 with the chamber 5, said pipe being extended through the duct or tube 21.

The air inlet port 27 is designed in practice to be connected by a tube or pipe 38 with a tracker bar (not shown) of a self-playing piano, and when so connected, the parts occupy the position shown in Fig. 4, when the air inlet pipe 38 is closed, by an imperforate portion of the music roll or sheet, but when the air inlet pipe 38 is uncovered by a perforation in the music roll or sheet, then the apparatus becomes effective.

When the parts are in the position shown in Fig. 4, it will be seen that the bellows are in communication with the atmosphere through the passages *p*, *o*, valve chest *j* and port *m*, and are cut off from the exhaust or vacuum chamber *g* by the valve 6, which closes the port and opens the port *m*. At the same time a vacuum is formed in the chamber *g* and also in the chamber *h*, for it will be seen that the chamber *h* is in constant communication with the valve chamber 30 through the pipe 36 and that said valve chamber is in communication with the chamber 24, the valve 32 being open and the valve 31 being closed, and that the chamber 24 is in constant communication with the vacuum chamber *g* through the duct 21. The apparatus remains in this condition as long as the air inlet pipe 38 remains closed. When, however, the inlet pipe 38 is opened to the air, as by a perforation in the music roll or sheet passing over its end, then air is admitted into the chamber 26, which acts on the diaphragm 25 and moves the same upward, until the valve 32 is closed and the valve 31 is opened. The closing of the valve 32 cuts off the chamber *h*, the pipe 36 and valve chamber 30 from the vacuum chamber *g*, and the opening of the valve 31 establishes communication between the chamber *h* and the atmosphere through the pipe 36 and valve chamber 30. Air is thus admitted into the chamber *h* and acting on the diaphragm *f* lifts the valve 6 so as to open the port *k* and close the port *m*, thereby connecting the chamber 5 of the bellows with the vacuum chamber *g* and cutting off the chamber 5 from the atmosphere, with the result that the air is exhausted from the bellows, which closes and effects the work desired, such as operating a hammer or other part of the piano or other musical instrument. As soon as the air inlet pipe 38 is again closed, the diaphragm 25 and its attached valves, 32, 31 drop, thereby closing the valve 31 and opening the valve 32, with the result, that the chamber *h* is again connected with the

vacuum or exhaust chamber *g* through the pipe 36, valve tube 30, chamber 24, and duct 21, whereupon the diaphragm *f* drops, and closes the port *k* with the valve 6, which uncovers the port *m* and again connects the bellows with the sphere, thereby filling the same and moving the part *b* back into its normal position. It will be observed that a vacuum exists under normal conditions in the chambers *g*, *h*, which are separated by the diaphragm *f*, but are in communication through the valve chamber 30, and that the continuance of the vacuum in the chamber *h* is controlled by the valves 31, 32, which are actuated by the auxiliary diaphragm 25, the position of which is determined by the opened or closed condition of the air inlet 38.

The box or casing *d* is detachably secured to the bellows *a* by the clamping bars 50, 51, and screws 52, 53, and the auxiliary box or casing 20 is detachably secured to the box or casing *d* by the screw 22, so that the different parts are capable of being quickly and easily assembled or taken apart, and when assembled as shown form a simple, compact, structure, which takes up but little room, thereby enabling the same to be applied to an ordinary upright piano and the bellows connected to the jack of the piano action. It will be noted that the chamber 24 is permanently connected with the main exhaust or vacuum chamber *g* and as a result the diaphragm 25 is rendered very sensitive and responds quickly when the air inlet 38 is uncovered.

I have herein described the invention as applicable for piano-players, but I do not desire to limit the invention in this respect.

From the above description it will be seen, that the auxiliary casing 20 with its diaphragm 25, valve chamber 30, and valves 31, 32, constitutes a primary pneumatic, which has two independent outlet pipes or tubes 21, 36, and which is detachably secured to the main wind chest or casing *d* by the screw 22; and that the chamber *h* with its diaphragm *f* constitutes a secondary pneumatic, which is controlled in its operation by the primary pneumatic, and that each primary pneumatic is individual with relation to each bellows.

Claims:

1. In an apparatus of the class described, in combination, a bellows provided with an air chamber, a main box or casing located above and attached to said bellows and provided with a diaphragm forming chambers on opposite sides of it, a valve chest carried by said box or casing and provided with a port leading to the atmosphere and with a port leading to one of the chambers of said box, a valve in said chest controlling said ports and having a stem or rod actuated by said diaphragm, means for connecting said valve

chest with the air chamber of said bellows, an auxiliary box or casing, one for each bellows, detachably attached to the main box or casing and provided with side walls, a diaphragm within said auxiliary box forming chambers, a tube attached to the auxiliary box and open at its opposite ends, a pipe connecting said tube with one of the chambers in the main box or casing, a duct connecting only the other of the chambers in the main box with a chamber in the auxiliary box or casing, a valve stem extended through said tube and actuated by the diaphragm in the auxiliary box or casing, valves attached to said stem and alternately opening and closing the opposite ends of said tube, and an air inlet for one of the chambers in the auxiliary box, substantially as described.

2. In an apparatus of the character described, in combination, a bellows, a main box or casing located above and attached to the said bellows and provided with a diaphragm forming upper and lower chambers, a valve chest carried by said box or casing and provided with a port communicating with the atmosphere and with a port communicating with the upper chamber in said box or casing, means connecting said valve chest with the said bellows, a valve in said chest controlling communication between the bellows and the atmosphere and the upper chamber in said box or casing, an auxiliary box or casing, one for each bellows, detachably attached to the main box and provided with side walls, a diaphragm in said auxiliary box forming upper and lower chambers, a tube carried by the auxiliary box and communicating with the atmosphere and with the upper chamber in said auxiliary box, a pipe connecting said tube with the chamber below the diaphragm in the main box, a duct connecting the upper chambers of said boxes only, an air inlet for the lower chamber of the auxiliary box, and valves actuated by the diaphragm in the auxiliary box for alternately connecting the chamber below the diaphragm in the main box with the upper chamber in said box, and with the atmosphere, substantially as described.

3. In an apparatus of the character described, in combination, a bellows, a main box or casing located above and attached to said bellows, a diaphragm forming chambers above and below it, the upper one being an exhaust chamber, a valve chest provided with a port communicating with said exhaust chamber, and with a port communicating with the atmosphere, means connecting said valve chest with said bellows, a valve controlling said ports operatively connected with said diaphragm, a tube connected with the chamber below said diaphragm and provided with ports, an auxil-

iary box or casing, one for each bellows, detachably secured to the main box or casing and provided with side walls, a diaphragm within said auxiliary box or casing forming a vacuum chamber and an air chamber, valves connected with the diaphragm in said auxiliary box and controlling communication between the chambers of said main box or casing and also controlling communication between the chamber below the diaphragm of the main box or casing and the atmosphere, said valves normally cutting off the chamber below the diaphragm of the main box or casing from the atmosphere and establishing communication between said chamber and the exhaust chamber of the main box or casing, and a duct connecting the vacuum chamber of the auxiliary box or casing with the exhaust chamber of the main box or casing.

4. In an apparatus of the character described, in combination, a bellows, a main box or casing located above said bellows and containing a diaphragm forming a chamber on one side of it that is an exhaust chamber and a second chamber on the other side of it, means for connecting the bellows with the said box or casing, a valve connected with the said diaphragm and controlling communication between the bellows and the atmosphere and with the said exhaust chamber, an auxiliary box or casing, one for each bellows, detachably secured to the main box and cooperating therewith, a diaphragm in said auxiliary box or casing forming an air chamber and an exhaust chamber, means for connecting said exhaust chambers, a tube communicating with the atmosphere and with the exhaust chamber of said auxiliary box or casing, means for connecting the said tube with the second chamber of the main box, and valves connected with the diaphragm of the auxiliary box for controlling communication between the second chamber of the main box and the atmosphere and between said second chamber and the said exhaust chambers, substantially as described.

5. In an apparatus of the character described, in combination, a bellows, a main box or casing located above and detachably secured to said bellows and provided with a diaphragm forming a chamber which is in the main exhaust chamber and a second chamber, means for connecting the bellows with the said box or casing, a valve actuated by said diaphragm for controlling connection of the bellows with said main exhaust chamber and with the atmosphere, an auxiliary box or casing, one for each bellows, having top, bottom and side walls, and detachably secured to the main box or casing, a diaphragm in said auxiliary box or casing forming chambers, one an auxiliary air chamber and the other an auxiliary exhaust

chamber, means for connecting said exhaust chambers individually, a tube capable of communicating with the second chamber of the main box or casing, the atmosphere and with the auxiliary exhaust chamber, and valves operated by the auxiliary diaphragm for alternately connecting the second chamber with the said exhaust chambers and with the atmosphere, substantially as described.

6. In an apparatus of the character described, in combination, a bellows, a main casing detachably secured to the top of said bellows and provided with an exhaust chamber, a valve controlling communication between said bellows and said exhaust chamber, a diaphragm operatively connected with said valve and forming above it a chamber which is said exhaust chamber and below it a second chamber, means for normally connecting said second chamber with said exhaust chamber, a valve controlling said connecting means, a diaphragm connected to said second valve, a casing for each bellows in which said second diaphragm is located and detachably secured to said main casing, an air chamber, formed by said second diaphragm within said second casing, and an air inlet for said air chamber, substantially as described.

7. In an apparatus of the character described, in combination, a bellows having its upper portion stationary and provided with a recess at its rear end, a main box or casing detachably secured to said bellows over said recessed portion, a diaphragm interposed between said main box or casing and said bellows and forming one chamber above it which is an exhaust chamber and a second chamber below it, a valve casing located on said main box or casing and communicating with the bellows, the exhaust chamber and the atmosphere, a valve in said valve casing provided with a stem actuated by said diaphragm, an auxiliary box or casing for each bellows detachably secured to the main box or casing, a tube in said auxiliary box open at its upper end to the atmosphere and at its lower end to the auxiliary box, valves for controlling the ends of said tube, a diaphragm in said auxiliary box forming a chamber above it which is an exhaust chamber and an air chamber below it and actuating the valves for said tube, a duct connecting said tube with the chamber in the main box or casing below the diaphragm thereof, a duct connecting the exhaust chamber of the auxiliary box with the exhaust chamber of the main box, and an air inlet for the air chamber of the auxiliary box, substantially as described.

8. In an apparatus of the character described, in combination, a bellows, a box or casing detachably secured to the top of said bellows near its rear end, a valve chest at-

tached to the top of said box or casing, means to detachably secure said box or casing to said bellows, a duct connecting the valve chest with said bellows, a diaphragm in said box or casing forming chambers above and below it, said chamber above the diaphragm having an air outlet, a valve in said valve chest, a stem to connect the said valve with the said diaphragm, an auxiliary box or casing individual to each bellows, means to detachably secure the auxiliary box or casing to the box or casing attached to the bellows, a diaphragm in said auxiliary box or casing forming chambers above and below it, a tube extended through the top of the auxiliary box or casing and open at its opposite ends, valves coöperating with the open ends of said tube and actuated in one direction by the diaphragm in said auxiliary box or casing, a pipe connecting the said tube with the chamber below the diaphragm in the box or casing attached to the bellows, a duct connecting the chamber in the auxiliary box or casing above the diaphragm with the chamber above the diaphragm in the box or casing attached to the bellows, and an air inlet pipe connected with the chamber below the diaphragm in the auxiliary box or casing.

9. In an apparatus of the class described, in combination, a bellows carrying a chamber, a main wind chest located above said bellows, a diaphragm interposed between the said wind chest and said chamber and coöperating with the chamber to form a secondary pneumatic below the wind chest, a valve actuated by said diaphragm for controlling the admission of air into said bellows, and a primary pneumatic individual to each bellows and detachably secured to the main wind chest as a unitary structure and communicating with the main wind chest and with said secondary pneumatic, substantially as described.

10. In an apparatus of the class described, a bellows, a main wind chest, a secondary pneumatic, a valve actuated by said secondary pneumatic for controlling the admission of air into said bellows, and a primary pneumatic individual to said bellows and communicating with both the main wind chest and with said secondary pneumatic and detachable therefrom, as a unitary structure capable of being tested independently of the secondary pneumatic and main wind chest, substantially as described.

11. In an apparatus of the character described, in combination, a bellows, a main wind chest located above and supported by said bellows, a diaphragm interposed between said bellows and said main wind chest to form chamber below it, a valve actuated by said diaphragm and controlling communication between the bellows and the

main wind chest, and an independent primary structure detachably secured to the main wind chest and communicating with the latter and with said chamber, a diaphragm in said primary structure, and a valve actuated by the latter diaphragm and controlling the admission of air into said chamber, substantially as described.

12. In an apparatus of the character described, a primary pneumatic comprising a casing containing a diaphragm to form chambers above and below it, an air inlet tube supported by said casing and communicating with the atmosphere and with the chamber above said diaphragm, a tube leading from the chamber above the diaphragm to the outside of the casing, a second tube leading from the air inlet tube, valves actuated by said diaphragm and cooperating with the air inlet tube, and an air inlet for the chamber below the diaphragm, substantially as described.

13. In an apparatus of the character described, a primary pneumatic comprising a casing containing a diaphragm forming chambers on opposite sides of it, an air inlet tube communicating with the atmosphere and with one of said chambers, a tube leading from the chamber with which said air inlet tube communicates, a second tube leading from said air inlet tube, means actuated by said diaphragm and cooperating with said air inlet tube to control communication of said second-mentioned tube with the atmosphere and with the chamber from

which the first-mentioned tube leads, and an air inlet for the chamber on the opposite side of said diaphragm.

14. In an apparatus of the class described, a bellows carrying a chamber, a main wind chest, a diaphragm interposed between the said main wind chest and chamber and cooperating with the latter to form a secondary pneumatic, a valve actuated by said secondary pneumatic for controlling the admission of air into said bellows, and a primary pneumatic individual to said bellows and communicating with both the main wind chest and with said secondary pneumatic and detachable therefrom as a unitary structure, substantially as described.

15. In an apparatus of the class described, in combination, a bellows carrying a chamber, a main wind chest, a diaphragm cooperating with the chamber to form a secondary pneumatic, a valve actuated by said diaphragm for controlling the admission of air into said bellows, and a primary pneumatic individual to each bellows and communicating with the main wind chest and with said secondary pneumatic and detachable therefrom as a unitary structure, substantially as described.

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

JONAS VANDIN.

Witnesses:

JAS. H. CHURCHILL,
J. MURPHY.