

May 22, 1923.

T. F. CHEEK

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PRESSURE REGULATOR FOR MUSICAL INSTRUMENTS

Filed April 1, 1920

3 Sheets-Sheet 1

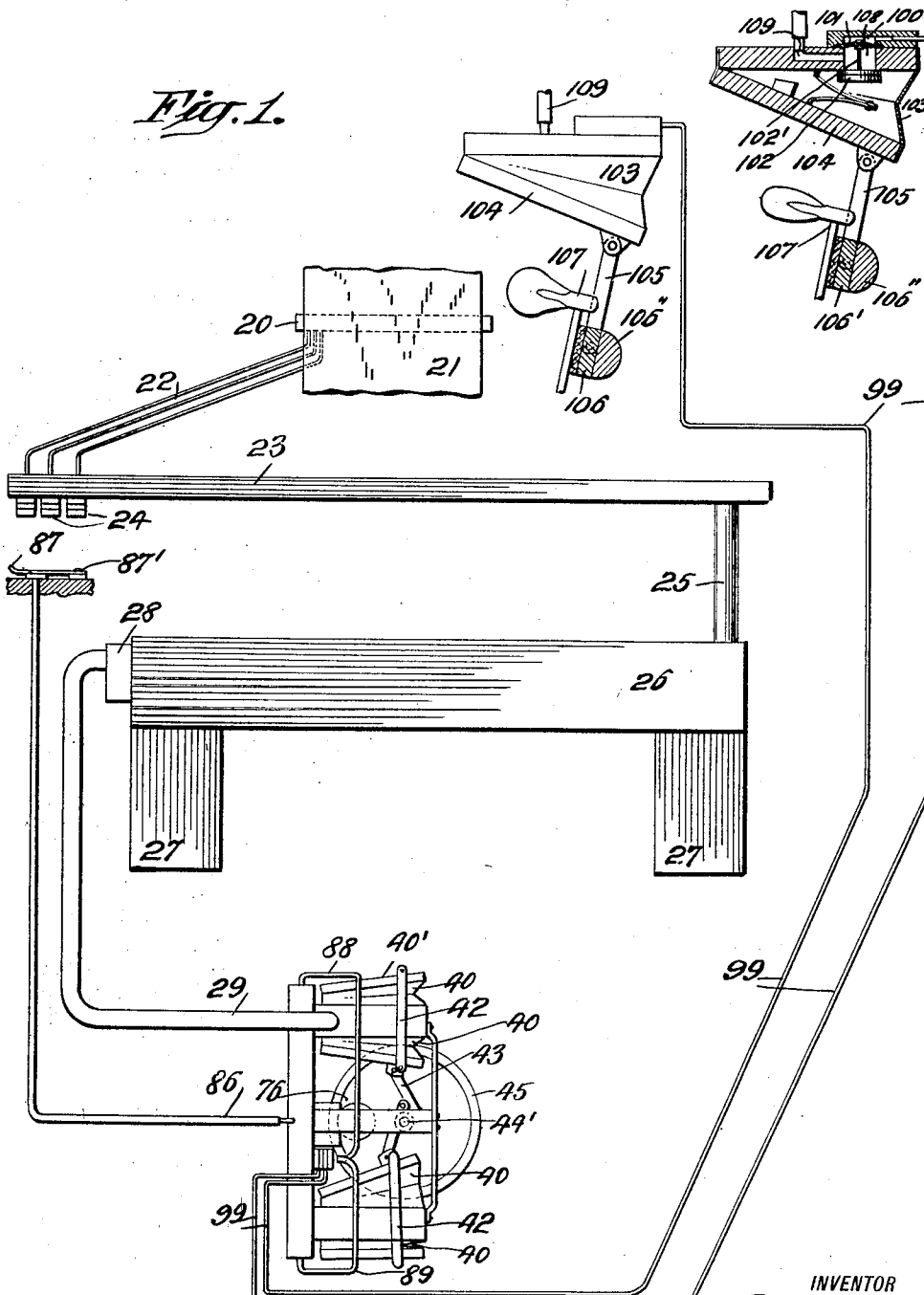


Fig. 1.

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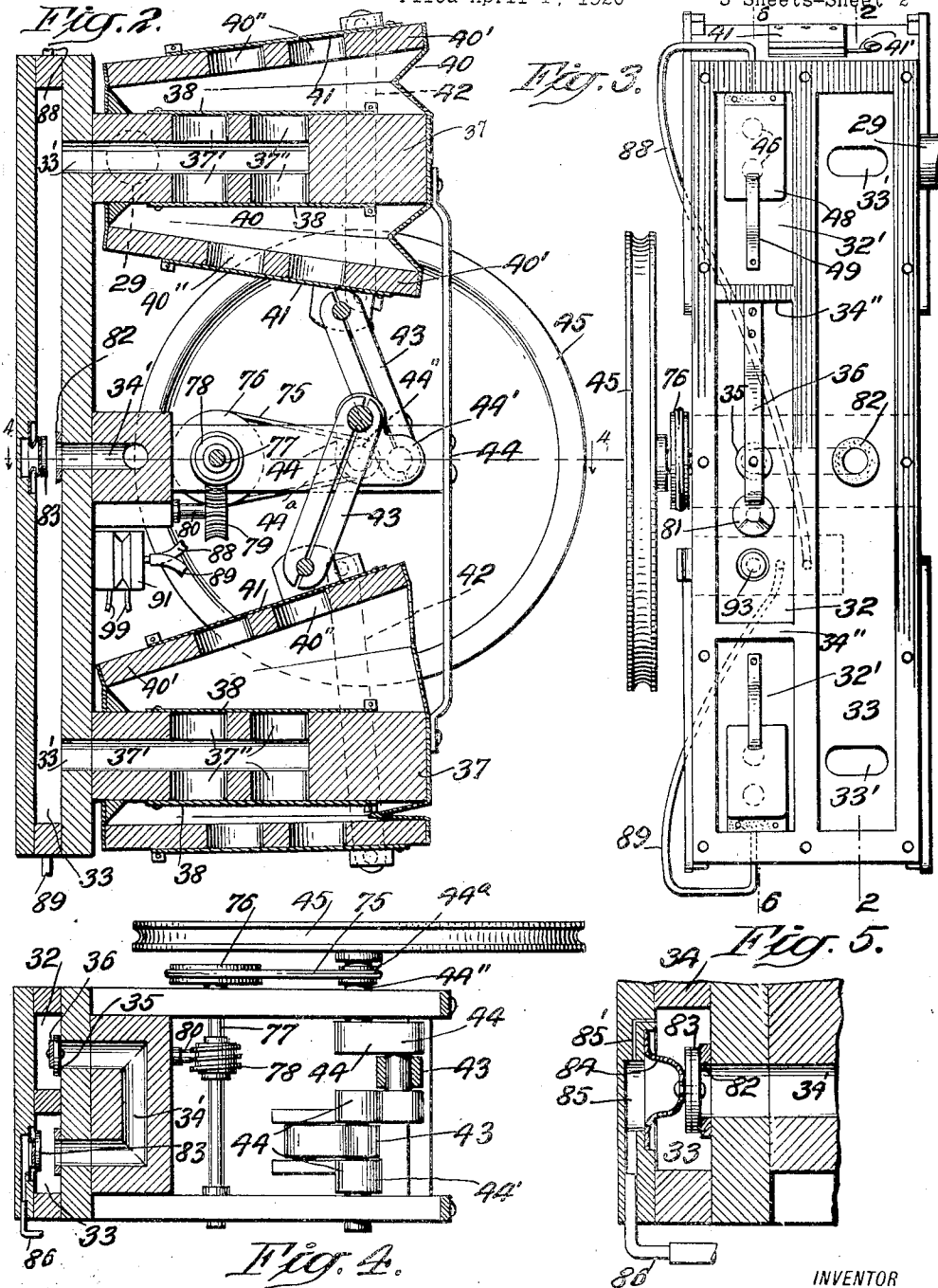
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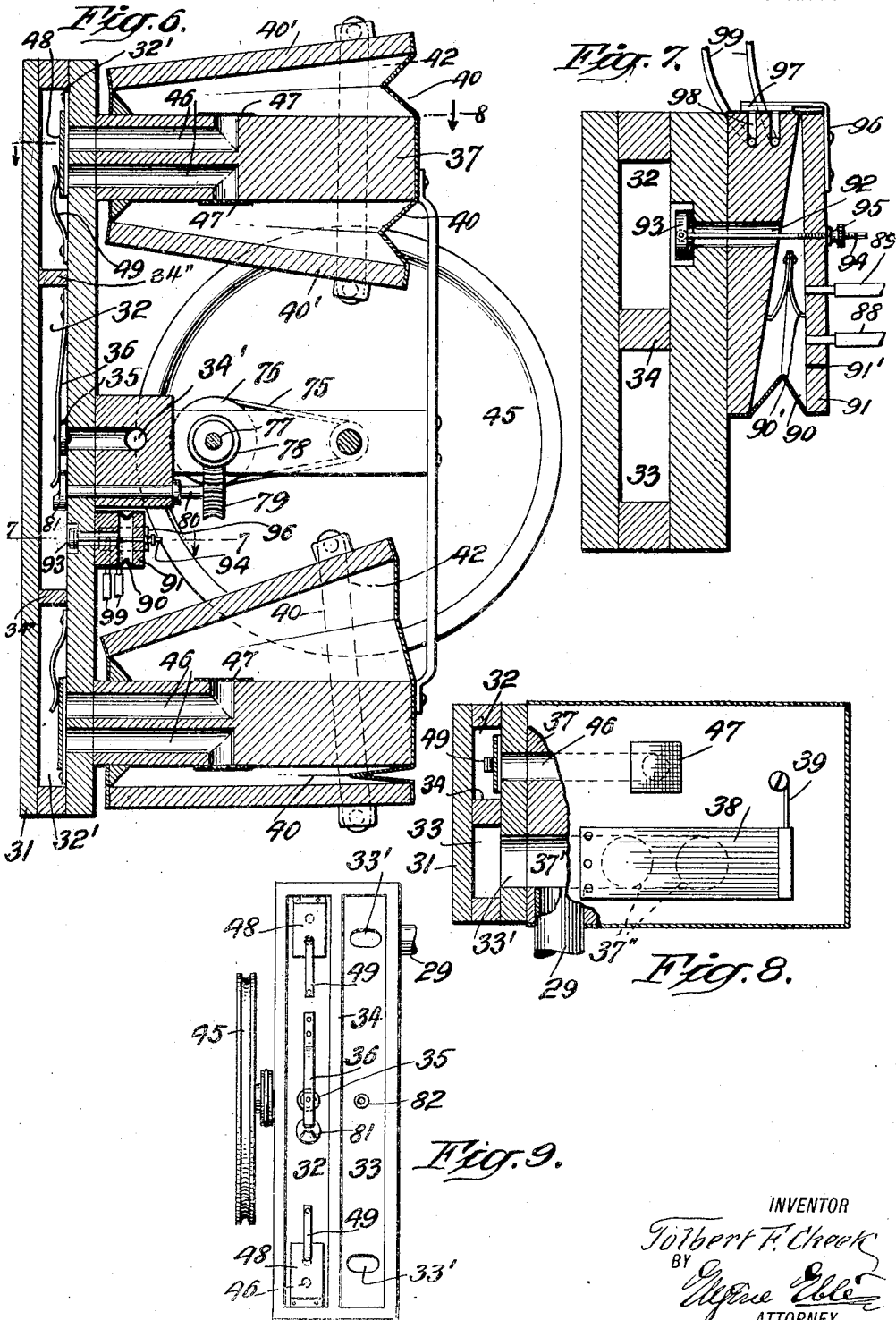
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# UNITED STATES PATENT OFFICE.

TOLBERT F. CHEEK, OF NEW YORK, N. Y., ASSIGNOR TO THE PHIL-HAR-CHEE PIANO PLAYER CORPORATION, A CORPORATION OF NEW YORK.

## PRESSURE REGULATOR FOR MUSICAL INSTRUMENTS.

Application filed April 1, 1920. Serial No. 370,611.

*To all whom it may concern:*

Be it known that I, TOLBERT F. CHEEK, a citizen of the United States, and a resident of the city of New York, Bronx Borough, State and county of New York, have invented certain new and useful Improvements in Pressure Regulators for Musical Instruments, of which the following is a specification.

My invention relates to pneumatic players for pianos and other musical instruments and has for its object to provide a constant pressure in the wind chest irrespective of the number of openings in the note sheet registering with the tracker board openings at any particular time. Another feature of my invention relates to a pneumatic control of the hammer rest rails, said control operating in conjunction with the pump which governs the pressure in the wind chest. The invention also embodies other novel features, as will appear from the description following hereinafter and from the appended claims.

Reference is to be had to the accompanying drawings in which Fig. 1 is a diagrammatic view showing so much of a pneumatic player as is required to disclose my invention; Fig. 2 is a vertical section of the pump, taken on the line 2—2 of Fig. 3; Fig. 3 is a rear view of said pump, with the cover or back taken off; Fig. 4 is a plan view of the pump, with parts in section on line 4—4 of Fig. 2; Fig. 5 is a detail horizontal section, on an enlarged scale, of the parts shown at the lower left hand corner of Fig. 4; Fig. 6 is a vertical section of the pump on the plane indicated by the line 6—6 of Fig. 3; Fig. 7 is a partial horizontal section, on an enlarged scale, taken on the line 7—7 of Fig. 6; Fig. 8 is a horizontal section substantially on the line 8—8 of Fig. 6; and Fig. 9 is a view, similar to Fig. 3, showing another form of my invention.

The devices shown in the present application have been designed primarily for the purpose of improving and simplifying the construction shown in United States Letters Patent No. 1,303,029, issued May 6, 1919, to Phil-Har-Chee Piano Player Corporation as the assignee of Tolbert F. Cheek, and many features of said patent are reproduced in the present application either identically or substantially, as is indicated by the use,

for said features or parts, of the same reference numerals as in said patent.

In Fig. 1, I have indicated at 20 the customary tracker over which moves the perforated music sheet 21 and from which air conduits 22 extend to the action chest 23 controlling the striker pneumatics 24 in any well known or approved manner, said chest being connected by a trunk 25 with a wind chest 26 having reservoirs 27. These parts may be of any approved construction and have been shown only for the sake of completeness. It will be understood that I may provide the usual pedal mechanism for creating and maintaining a vacuum in the wind chest 26, but the presence of such pedal mechanism is not essential to my invention, that is to say, the device may be operated without any pedal mechanism.

The wind chest 26 communicates with a small chamber 28 from which a pipe 29 leads to the pump, the back of said pump being indicated at 31. Adjacent to this back are two chambers separated by a vertical partition 34, and one of said chambers is subdivided by two horizontal partitions 34' into two end compartments 32' and a middle compartment 32, the other chamber 33 being continuous from top to bottom. This chamber 33 is connected with the central compartment 32 by a channel 34' (of U-shape, as shown best in Fig. 4) controlled by a valve 35 located in the compartment 32. A spring 36 tends to close this valve and thus to disconnect the compartment 32 from the chamber or compartment 33. The latter is in permanent communication with the pipe 29 through the upper of two connections 33' communicating with passages 37' in stationary boards or members 37, said pipe 29 opening to the upper passage 37', see Figs. 2 and 8.

From each of the passages 37', ports 37'' controlled by flap valves 38 (provided with springs 39 of usual character) lead to the interior of bellows 40, the movable end members of which, 40', are provided with ports 40'' adapted to open to the outside air when the outwardly opening flap valves 41 (provided with springs 41') are unseated. There are four movable bellows members 40' arranged in pairs on opposite sides of each of the stationary members 37 and the two members 40' of a pair are connected by links 42,

the ends of which are pivoted to the respective boards or members 40'. The two innermost movable members 40' are connected pivotally with rods 43, the other ends of which are pivoted to cranks 44 and 44' secured to the drive shaft 44''. Preferably the two cranks 44 and 44' are set at 90 degrees from each other. The shaft 44'' is driven in any suitable manner as by means of a belt applied to the pulley 45 and generally the motive power is supplied by an electric motor. In the neighborhood of the horizontal plane containing the channel 37' each of the stationary members 37 is provided with two channels 46 preferably superimposed as indicated in Figs. 3 and 6, which channels extend to the interior of the bellows 40, where their orifices are covered by strips 47 of felt or other material sufficiently porous to allow air to be drawn through. The purpose of these cover strips is to avoid noise which might result from the suction. The ends of the channels 46 adjacent to the chamber or compartment 32' are normally closed by flap valves 48, pressed toward said channels by springs 49.

The valve 35 is opened periodically, at definite intervals corresponding to the speed of the pump, by the following mechanism which is governed by the operating shaft 44'' of said pump. The said shaft, by means of a pulley 44<sup>a</sup>, a belt 75 and a pulley 76, drives a countershaft 77 from which motion is transmitted, by a worm 78 and a worm wheel 79, to a transverse shaft 80 carrying at its end, within the compartment 32, a cam 81 so fashioned that the valve 35 will be opened thereby once for each revolution of the shaft 80, said cam engaging the free end of the spring 36, see Fig. 6.

I also provide mechanism under the control of the operator for closing the passage 34' irrespective of the operation of said valve 35. For this purpose, a valve seat 82 is arranged at that end of the passage 34' which opens into the compartment 33, and this seat is adapted to be engaged by a valve 83 carried by a diaphragm 84 which forms a movable wall of a chamber 85, as shown best in Fig. 5. One end of a pipe 86 is connected with this chamber, the other end of this pipe being normally closed by a valve 87 within easy reach of the operator; by swinging this valve laterally on its pivot 87', the outside air may be admitted to the pipe 86 and to the chamber 85, causing the diaphragm 84 to pass from the normal inactive position (Figs. 2 and 4) to the active position (Fig. 5) in which the valve 83 closes the passage 34', this having the same effect as the closing of the valve 35, which effect will be described below. A bleeding channel 85' causes the normal position of the diaphragm and valve 83 to be restored when the valve 87 is closed. I may add

that the pipe 86 and valve 87 are similar in function to the pipe 71 and valve 72 of the Cheek patent referred to above, although the connection of the pipe 86 is somewhat different from that of the pipe 70.

From the upper and lower compartments 32' conduits 88, 89 respectively lead to the interior of a small bellows 90, the ends of said ducts being shown attached to the movable board 91 of said bellows, which board is also provided with a vent 91'. A spring 90' tends to open the bellows. The interior of the bellows communicates at times with the compartment 32 by a passage 92 controlled by a valve 93, operated from the movable member 91 of the bellows 90 by a rod 94 and an adjustable nut or abutment 95. To the movable member 91 is secured rigidly a bracket 96 carrying a valve 97 which, when the bellows is expanded (Fig. 7) closes one end of each of two channels 98. Should the bellows collapse, these ends will be uncovered, so as to connect the channels 98 with the atmosphere. The channels 98 are in permanent communication with two pipes or conduits 99, each leading to a separate chamber 100 (Fig. 1), which has a movable wall formed by a diaphragm 101. A valve 102 connected with the diaphragm by a rod 102', is located within a bellows 103 the movable member 104 of which is connected, by a link 105, with an auxiliary hammer rest rail 106, 106' respectively, both of which normally engage the ordinary pedal-operated hammer rest rail 106'' extending continuously, while the rails 106 and 106' are much shorter, one of them corresponding to the bass and the other to the treble. It will be understood that normally the rails 106, 106' extend in longitudinal alignment, although for the purpose of illustration they have been shown otherwise in the diagram Fig. 1, which also seems to show two rails 106'', it being understood however that there is but one (continuous) rail 106''. When the valve 102 is open the interior of the bellows 103 communicates through a channel 108 with a duct or conduit 109 leading to a pneumatic chest or other device (not shown) for creating a pressure different from atmospheric pressure. The connections 109 are controlled by the so-called soloist pneumatics (one for bass and one for treble) not illustrated herein, as they are well known in the art.

The operation is as follows: As the rotation of the shaft 44'' reciprocates the movable boards 40' of the bellows 40, air is sucked into said bellows (and expelled through the valved openings 40'') from the passages 37', and by the connections 33' suction is thus created in the compartment 33, and at regular intervals of time (once for each revolution of the shaft 80, in the particular case illustrated) as the valve 35 is

opened by the action of the cam 81 on the spring 36, so that suction is exerted through the channel 34' and temporarily places the compartment 32 under the same degree of vacuum as the compartment 33. As long as the cam actuated valve 35 is closed, there is no suction in compartment 32, and the spring 90' keeps the bellows 90 and connected parts in the position illustrated by Fig. 7, the valve 93 closing the channel 92, so that no suction exists either in the bellows 90 or in the compartments 32' connected therewith by the conduits 88, 89. The valve 97 is closed, and the bellows 104 expanded as in Fig. 1, the valves 102 being closed. Suction is also created constantly in the pipe 29 and in the wind chest 26, since these communicate with the upper passage 37' and compartment 33. The air sucked into the compartment 33 generally comes from the pipe 29 and wind chest 26; if however, only a few notes are being played at a particular time, so that the amount of air passing into the wind chest from the openings of the tracker bar does not correspond to the capacity of the pump, an additional amount of air will circulate through the pump as follows, the valve 93 opening automatically in this case: From bellows 40 through channels 46 and past valves 48 into upper and lower compartments 32', then through conduits 88, 89 to bellows 90, (the latter collapsing) past valve 93 into compartment 32, through passage 34' into compartment 33 at such times as the cam 81 opens the valve 35, and from compartment 33 back to the pump through connections 33' and passages 37'. The pressure in the wind chest 26 is thus kept practically constant, irrespective of the number of notes played together or in quick succession at any particular time.

The connection just described forms a second by-pass co-operating with the by-pass first described, and by means of this second by-pass I obtain automatically a varying volume of sound in the playing of the music, each note being struck with practically the same force and the instrument therefore playing with a great volume of sound when a comparatively large number of notes occur at the same time or in quick succession, whereas a smaller volume of sound, that is to say, a softer playing is obtained automatically whenever there are only a few notes at the same time or in quick succession.

Whenever the bellows 90 is collapsed, the valve 97 opens the ducts 98 and conduits 99 to the atmosphere, and if (through well-known connections) one of the conduits 109 is at that time in communication with a vacuum, the diaphragm 101 associated with that particular conduit (that is, either bass or treble) will at that time be moved, by the air pressure in chamber 100, so as to open the

valve 102 and cause the bellows 103 to collapse. Thus the auxiliary rail 106 or 106' will be shifted in such a manner as to soften the tones corresponding to the hammers 107 in the bass or treble respectively, but this action, as explained above, depends on the collapsing of the bellows 90 which can take place only when the valve 35 is open. Inasmuch as the opening of the valve 97 and the shifting of the auxiliary hammer rest rail 106 or 106' coincides with the establishment of a by-pass through which a certain amount of air may circulate through the pump, it follows that this shifting of the auxiliary hammer rest rail is simultaneous with a reduction of the vacuum in the wind chest 26 and in the striker pneumatics 24, so that a double softening of the notes is obtained in this case. Whenever the valve 35 closes, the bellows 90 resumes the position shown in Fig. 7, causing the pneumatics 104 to return to the position indicated in Fig. 1.

In Fig. 9 I have illustrated a construction differing from the one described above, by the fact that the partitions 34'' are omitted, so that the compartment 32, like the compartment 33, extends the full height of the pump. The parts numbered from 88 upward to 106 and 106' inclusive, as well as the parts 108 and 109 are omitted in this case, that is to say, there is in this case no pneumatic control of auxiliary hammer rest rails, but in other respects this form of my invention will operate in substantially the same manner as the form first described. The by-pass for the circulation of air through the pump is simpler in Fig. 9 than in the other form, inasmuch as both valves 48 open directly into the same chamber or compartment 32.

In each form of the invention, the operator by opening the valve 87, can admit air under atmospheric pressure to the chamber 85, causing the diaphragm 84 to bring the valve 83 against the seat 82, so that the connecting channel 34' remains closed even when the cam 81 opens the valve 35.

Various modifications may be made without departing from the nature of my invention as set forth in the appended claims.

I claim:

1. In an automatic player for musical instruments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, said by-pass including a valve chamber, a valve located in said chamber and controlling said by-pass, a valve-opening cam arranged in said chamber, and means in positive relation to the operation of said pump for driving said cam.

2. In an automatic player for musical in-

struments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, means in positive relation to the operation of said pump for periodically opening said by-pass, another by-pass connected with said first-named by-pass, and means for bringing said second-named by-pass into operation automatically to regulate the pressure in said wind chest so as to produce the desired volume of sound.

3. In an automatic player for musical instruments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, a valve controlling said by-pass, a spring normally closing said valve, and a rotary cam in positive relation to the operation of the pump for engaging said spring permanently and opening the valve periodically.

4. In an automatic player for musical instruments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, a valve opened periodically in positive relation to operation of the pump and controlling said by-pass, another valve, normally open, which likewise controls said by-pass and means for controlling said last-named valve manually.

5. In an automatic player for musical instruments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, a valve controlling said by-pass and opened periodically as the pump operates, another valve, normally open, which likewise controls said by-pass, a movable wall operatively connected with the last-named valve and exposed on one side to the pressure existing in said by-pass, and manually controlled means for placing the other side of the said movable wall under the pressure of the surrounding air, or disconnecting it therefrom.

6. In an automatic player for musical instruments, the combination of a wind chest, a pump connected with said wind chest and provided with a by-pass for allowing a portion of the air set in motion by the pump to circulate within the pump, a valve controlling said by-pass and opened periodically as the pump operates, another valve, normally open, which likewise controls said by-pass, a movable wall operatively connected with the last-named valve and exposed on one side to the pressure existing in said by-pass, and manually controlled means for connecting the other side of said movable wall with a source of a pressure different from that prevailing in said by-pass, or disconnecting it therefrom.

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