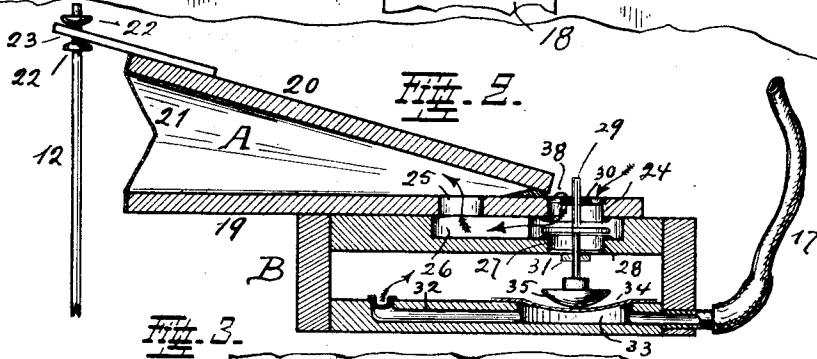
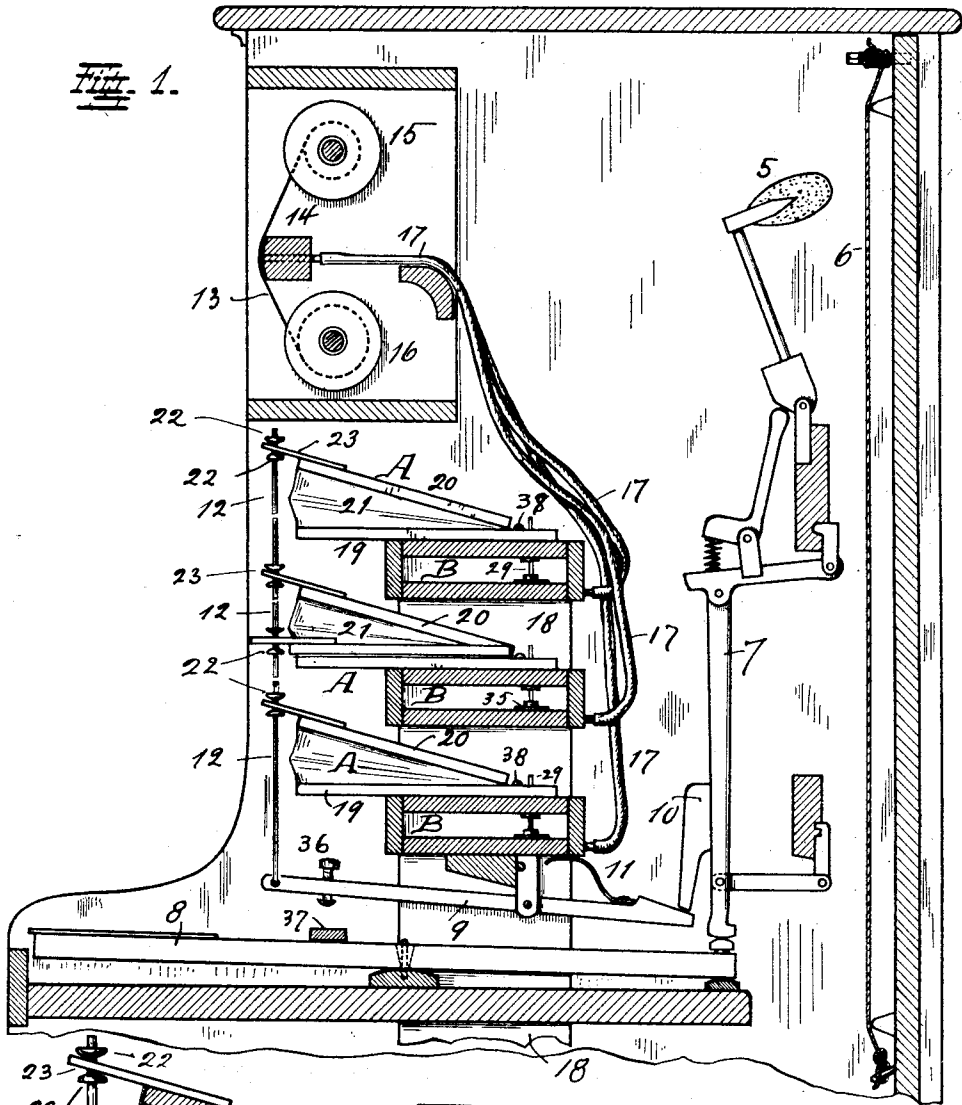


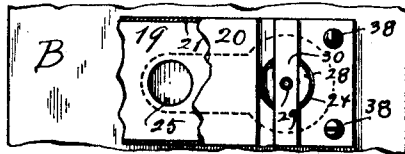
C. A. LAMBERT.  
 PNEUMATIC PIANO.  
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1,106,822.

Patented Aug. 11, 1914.



Witnesses:  
 Otto Gruen  
 J. A. Hammond.



Inventor:  
 Clayton W. Lambert  
 by C. Spengel atty.

# UNITED STATES PATENT OFFICE.

CLAYTON A. LAMBERT, OF INDIAN VIEW, OHIO, ASSIGNOR TO THE JOHN CHURCH COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

## PNEUMATIC PIANO.

1,106,822.

Specification of Letters Patent. Patented Aug. 11, 1914.

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To all whom it may concern:

Be it known that I, CLAYTON A. LAMBERT, a citizen of the United States, and a resident of Indian View, Hamilton county, State of Ohio, have invented certain new and useful Improvements in Pneumatic Pianos; and I do declare the following to be a clear, full, and exact description of the invention, attention being called to the drawing which accompanies this application and forms a part thereof.

This invention relates to certain new and useful improvements in pneumatic piano players.

It consists more particularly of features of construction used in connection with the means and devices concerned in the control and passage of the air, all as described more fully hereinafter and pointed out in the claim.

The features of the invention are illustrated in the accompanying drawing, in which:—

Figure 1 shows in vertical cross-section most of the upper part of a pneumatic piano player of a customary type. Fig. 2, shows a part of this view on an enlarged scale, it being more particularly a vertical section of one of the pneumatic elements. Fig. 3, shows part of a top-view of such an element.

Numeral 5, indicates one of the hammers of the piano action and is adapted to co-act with a complementary string 6, when actuated by means of a lifter-rod 7, sometimes also called an abstract, and by a series of intervenient instrumentalities of which the most essential ones are shown. A detailed description of these parts is omitted, since no novelty is claimed for them. Rods 7 may be actuated by key-levers 8, in case provision is made for manual playing of the instrument. In case of pneumatic operation, levers 9 serve, which act upon the lifter-rods by means of noses 10 thereon, there being a lever for each lifter-rod 7. Levers 9 are held in normal, that is inoperative position, by the weight of lifter-rods 7 and the connected parts, which action may be augmented by springs 11. Levers 9 are actuated by pneumatic elements A which act upon them by means of push-rods 12, it being of course understood that there is such an element, a connected push-rod 12, lever 9 and lifter-rod 7 for each hammer. The oper-

ation of the pneumatic elements for the purpose of acting on their respective hammers is controlled by the usual perforated music-sheet 13, co-acting with a tracker-bar 14, while passing between rotary spools 15 and 16, one of which is driven. This controlling action is transmitted to the pneumatic elements by means of tubular conduits 17, one leading to each element and in open communication with wind-chests B. A vacuum is maintained in these latter which by means of ducts 32 extends to conduits 17 and is derived from the action of the usual vacuum-motor or pumpers, in connection with a general suction-chamber with which these chests are in open communication by means of a conduit 18.

The pneumatic elements are substantially bellows consisting each of a base-plate 19, whereby they are attached to the wind-chests, of a movable flap 20 and of a flexible side 21, connected to both, the whole forming a collapsible inclosure which may be distended to the extent permissible by the stretch of flexible side 21. Normally, these elements are held in their expanded condition, holding up flaps 20, by levers 9, while these latter are also in their normal position, and by rods 12 which connect said levers and said flaps as before described. This connection as to the rods is by two spaced screw-washers 22—22, which engage between them fingers 23, one extending from each flap. Normally, elements A are open to the atmospheric air by means of conduits, consisting each of an outer or air-port 24, an inner port 25 and a duct 26, which connects both ports. These latter are located in the base-plate of the elements, while the ducts are formed below the underside of the base-plates and in the outer side of the upper wall of the wind-chest.

27 is a suction port by which communication may be established between duct 26 and the interior of the wind-chest, which communication is subject however to control by a valve 28, contained in a valve-chamber formed by an enlargement of duct 26. This port 27 is alined with port 24 and valve 28 is adapted to close either one, it being free to move in the space between these two ports, a seat for it being provided around each port, one seat being formed on the underside of base-plate 19, and the other on the bottom of duct 26. A stem 29 is pro-

vided for proper guidance of the valve, engaged by two guides 30—31, to direct the movement of the same.

5 Tubes 17 communicate with chest B as before described, and by means of ducts 32, formed in the lower wall of the wind-chest and which ducts are enlarged to form air-chambers 33 one below each port 27. A flexible diaphragm 34 closes each air-chamber 10 toward the interior of the wind-chest and upon this diaphragm there rests a push-button 35, affixed to the lower end of the valve-stem.

15 Normally the parts are in the position shown in Fig. 2, that is to say, valve 28 closes port 27 to maintain the vacuum in chest B, which vacuum extends through duct 32 and tubes 17 to the openings in the tracker-bar, which openings are also closed 20 by the intact portion of the music-sheet. If now one of the perforations in this latter passes over an opening in the tracker-bar, air is instantly admitted to the particular tube reducing momentarily the vacuum. 25 The admitted air rushes to the chest and while passing through duct 32 and through air-chamber 33, fills this latter instantly, thereby creating an impulse which by its reaction upon diaphragm 34 causes this latter 30 to bulge upwardly. This movement of the diaphragm through the intervention of the push-button resting upon it, throws valve 28 off from its seat and opens port 27. The same movement also raises the valve against 35 port 24, so as to close this latter, thereby cutting off the outer air from the interior of element A. This latter is now in open communication with the wind-chest and inasmuch as the limited quantity of air entering 40 through the tracker-bar and admitted to the chest is insufficient to overcome the preponderating counter-action of the vacuum therein, the air is instantly sucked out of element A. A collapse of this latter follows, causing actuation of the corresponding 45 lever 9, by means of rod 12 and a sound-producing operation of the corresponding hammer 5. Closure of the opening in the tracker-bar by the controller sheet, whereby 50 the outer air is cut off from the wind-chest, restores the parts to their normal and inactive positions.

To permit adjustment and regulation of the operation of each individual pneumatic 55 element with reference to its corresponding hammer, regulating means are provided as for instance screws 36, one seated in each lever 9 and adapted to co-act with a stop-bar 37.

60 It is essential, in order to insure prompt action of the pneumatic elements, to have the air-way to them from the outside as well as from chest B, as short and direct as possible. This is obtained by the means shown, 65 that is by having ducts 26 immediately be-

low each element A, and by locating the air-port 24 and the suction port 27, so as to be in direct communication with this duct.

The operation of the valves is quite sensitive and quickly affected by disarrangement 70 or slight obstructions. The pneumatic elements are subject to defects like leakage for instance and effects of wear. This requires close attention and makes frequent access to these elements and valves necessary. It is 75 desirable and quite essential that such access may be had quickly and direct without disturbing other parts not involved. I accomplish this by making removal of each individual element possible, for which purpose 80 each is separately attached by screws 38 which engage the extended base-plate 19 of each element and are seated in the upper wall of the wind-chests. By removing these screws, any element may be taken out, independently and without interfering with any 85 other and inasmuch as the extended part of these base-plates forms also the top of the valve-chambers below them immediate access to these valve-chambers is had at the 90 same time. Repairs and renewal of parts, duplicate parts being on hand, may thus be quickly made, without interfering with the use of the piano to any appreciable extent. This is of great advantage in view of the 95 fact that many of these instruments are used under circumstances where interference with their use is very objectionable, as for instance where they are rented out, or used in public places. 100

Having described my invention, I claim as new:

A pneumatic action for pneumatic pianos, comprising a collapsible element which consists of a movable flap and of a base-plate 105 which the flap is secured by a collapsible side, the base-plate being extended at one of its ends beyond the flap and provided with two perforations which extend through its entire thickness, one of them being located 110 below the flap and constituting a suction port for the element, the other one being located in the extended part of the base-plate to form an air-port, a wind-chest which comprises two spaced walls one of which is perforated to form a suction-port, the perforation being equal in diameter to the air-port 115 mentioned, this suction-port being circumferentially enlarged between inner and outer sides of the wall in which it is located to 120 form within the thickness of said wall a valve seat, also a valve-chamber above said seat which chamber is contiguous to the outer side of the wall, there being also a duct within the thickness of this wall which 125 extends laterally from said valve-chamber and is open on the outer side of said wall, the element being secured at its base-plate against said outer side and in a manner that the air-port in the extended part of said 130

base-plate registers with the suction-port in the wind-chest and that the suction-port in said base-plate alines with the end of the duct below the base-plate so that this latter  
5 serves also to cover said duct, and a valve contained in the valve-chamber mentioned and movable in the space between the valve-seat therein and the under side of the extended part of the base-plate and adapted  
10 to close either the air-port in said base-plate,

or the suction-port in the wind-chest, thereby controlling communication of either of these ports with the duct which leads to the element.

In testimony whereof, I hereunto affix my 15 signature in the presence of two witnesses.

CLAYTON A. LAMBERT.

Witnesses:

T. A. HAMMOND,

C. SPENGL.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."