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PNEUMATIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS.

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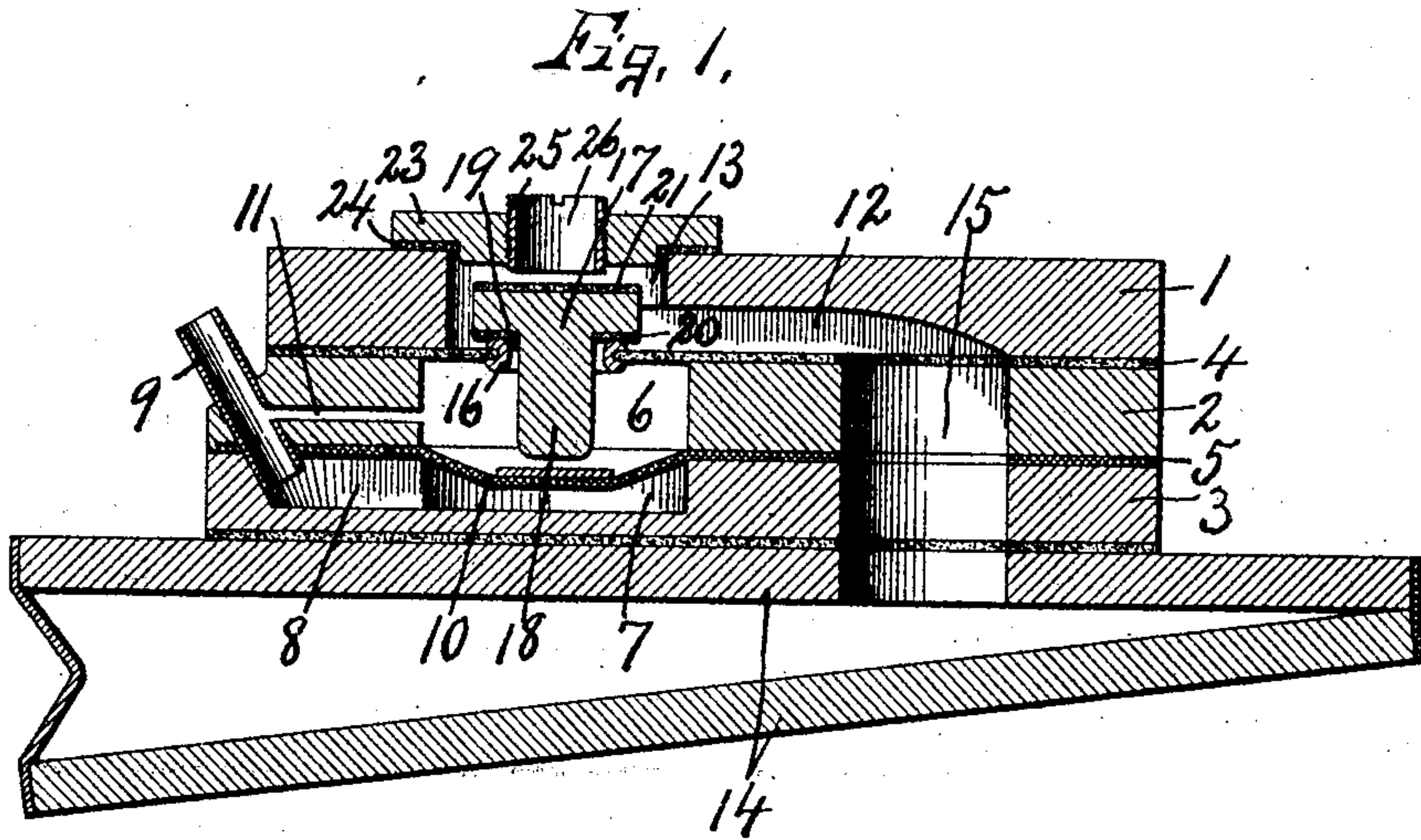


Fig. 3.

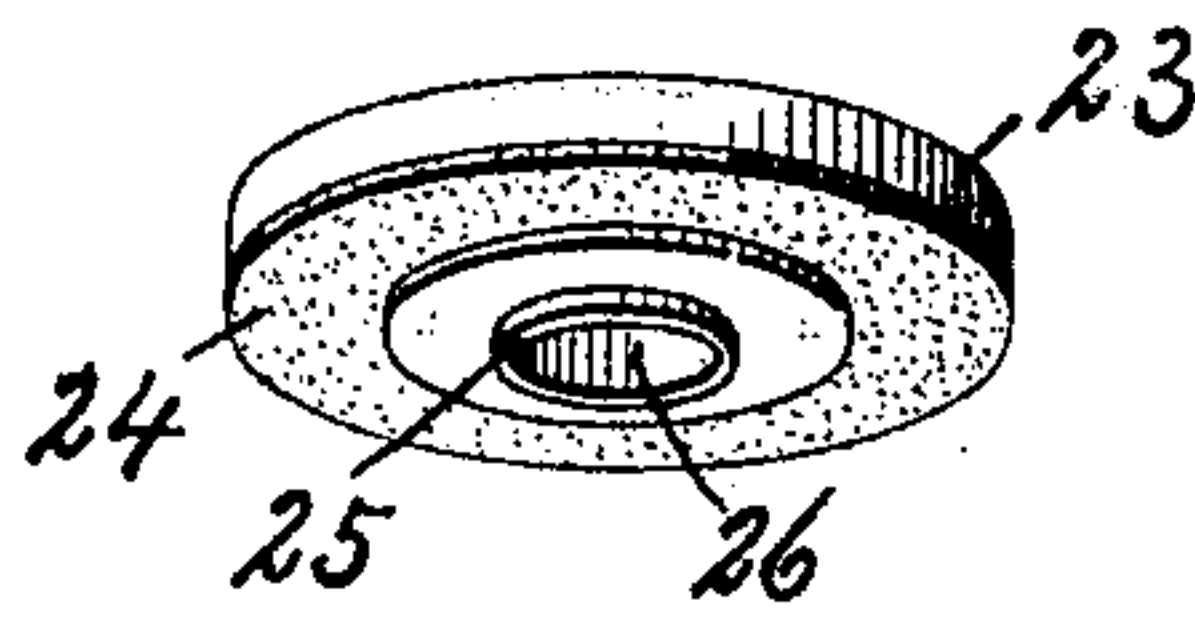
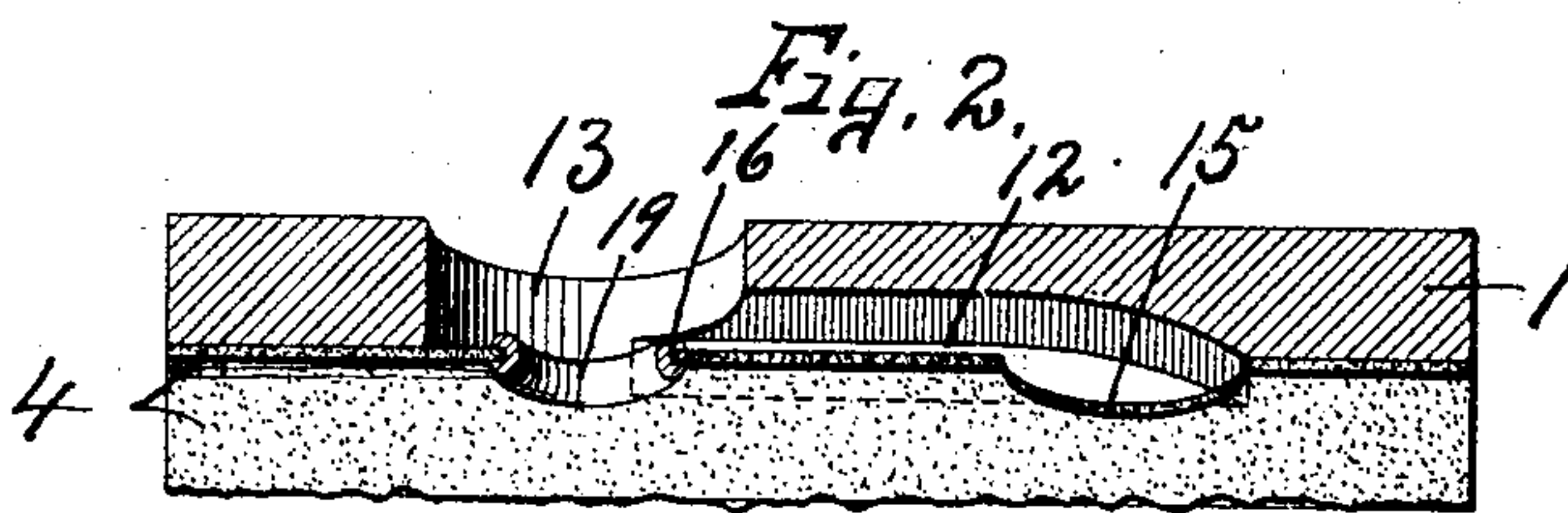
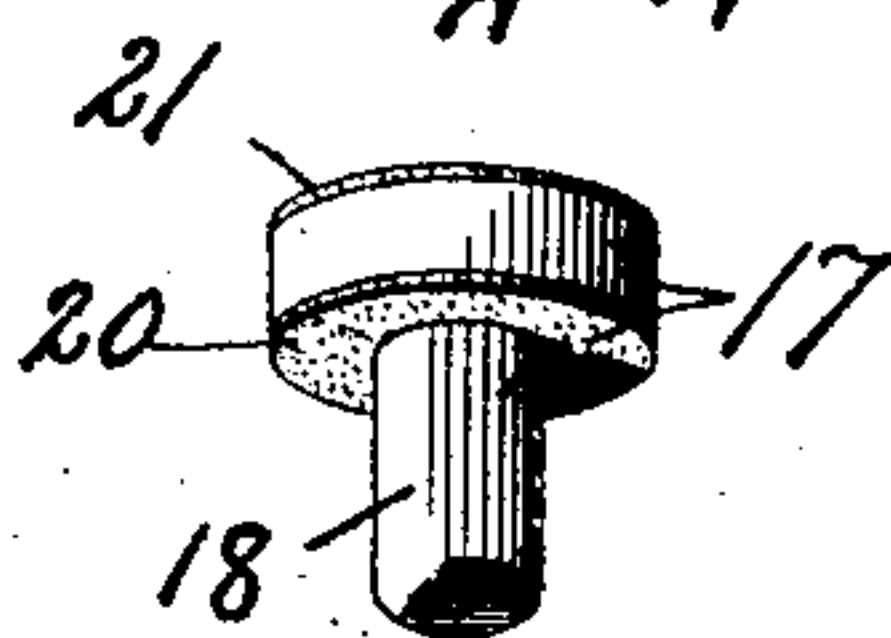


Fig. 4.



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## PNEUMATIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS.

No. 814,677.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed August 8, 1904. Serial No. 219,938.

*To all whom it may concern:*

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

This invention relates to improvements in pneumatic playing apparatus for musical instruments, and refers more particularly to the valve action for controlling the operation of the striker-pneumatic. In this class of apparatus the valve is controlled by what is termed a "primary pneumatic," which is in communication with an exhaust-chamber and one of the ducts of the tracker-board over which a perforated music-sheet travels and operates to control the action of the primary pneumatics by causing a variation of air-pressure at opposite sides of the primary pneumatic. Each striker-pneumatic is adapted to operate one of the keys of the musical instrument and has its individual controlling-valve and primary pneumatic in communication with one of the ducts of the tracker-board, (not shown,) and a number of these individual primary and striker pneumatics and their controlling-valves are usually grouped together in a single shelf, which comprises the valve-board and wind-chest and suitable ports and passages whereby communication is established between the primary and striking pneumatics and atmosphere. These shelves are usually built up in sections in order to facilitate the work of assembling and repairs, and it therefore becomes necessary to make the joints between the sections absolutely air-tight in order to secure positive and rapid action of the key-operating pneumatics. I have discovered that this instantaneity of action may be best secured by making the operating parts as light and as few in number as possible and by interposing a yielding flexible material, such as pasteboard, between the joints of the shelf-sections.

One of my objects, therefore, is to employ a single valve only between each primary pneumatic and its striker-pneumatic and to make this valve and its stem from a single piece of light material, such as wood, so that the stem

of the valve coacts with the walls of its port to guide the valve in its vertical movement. 55

Another object is to adhesively secure the opposite faces of a flexible or yielding separator or partition, such as pasteboard or equivalent material, to the adjacent faces of the valve-board and wind-chest, so as to afford a yielding connecting body to permit a slight shrinkage or expansion of the valve-board or wind-chest without opening the joint. 60

Another object is to extend this yielding partition across the exhaust-chamber of the wind-chest and to provide it with a port having an annular metallic valve-seat which is crimped over and upon the edges of the port-opening, so as to leave a circular port in the metallic seat. 70

A further object is to provide the valve-board with a series of openings, one for each valve, each opening being sufficiently large to permit the insertion and removal of the valve and to close each opening by a separate cap which is yieldingly secured to the valve-board with an interposed flexible separator, such as pasteboard or equivalent material, in the joint and around the opening, so as to permit a slight yielding action when the parts shrink or expand without opening the joint, the opposite faces of this separator being permanently cemented or glued to the adjacent faces of the parts, thereby leaving the central body of the separator more or less yielding to the "come and go" of said parts. 85

Other objects and uses will appear in the following description.

In the drawings, Figure 1 is a transverse sectional view through the shelf and one of the key-operating pneumatics secured thereto. Fig. 2 is a fragmentary sectional view in perspective of a portion of the valve-board, showing particularly the pasteboard bottom and air passages or ports. Figs. 3 and 4 are perspective views, respectively, of one of the caps for the valve-board opening and the valve which plays between the primary pneumatic and said cap. 95

Similar reference characters indicate corresponding parts in all the views. 100

The shelf consists, essentially, of a valve-board 1 and an underlying wind-chest composed of sections 2 and 3 of substantially the same size as the valve-board, these parts being formed of wood or similar light material 105



and are secured together face to face with interposed separators 4 and 5 of light thin material, such as pasteboard or equivalent flexible or yielding substance. These separators  
 5 are glued or otherwise cemented to the adjacent faces of the parts 1, 2, and 3, so as to form air-tight joints and still are sufficiently yielding to permit of slight expansion or contraction of said parts 1, 2, and 3 without  
 10 opening the joints.

The wind-chest is provided with an exhaust-chamber 6 and a series of individual pockets 7, which communicate, through a passage 8, with an air-duct 9, said air-duct  
 15 being adapted to be connected to one of the ducts of the tracker-board. (Not shown.) Each pocket is provided with a superimposed primary pneumatic 10, which is interposed between the adjacent faces of the wind-chest  
 20 sections 2 and 3, below the exhaust-chamber 6, and therefore cuts off communication between each pocket and the exhaust-chamber. A partial vacuum is maintained in this exhaust-chamber by any suitable pneumatic  
 25 means not necessary to herein illustrate or describe, and I preferably establish communication between the exhaust-chamber 6 and duct 9 through the medium of a branch duct 11, so as to maintain a normally equal air-  
 30 pressure above and beneath the primary pneumatic 10 and in the air-duct 9.

The valve-board 1 is provided with individual air-channels 12, each of which communicates at one end with the atmosphere  
 35 through an opening 13, while the other end of the channel communicates with a key-operating pneumatic 14 through an air-passage 15 at one side of the chamber 6 and pockets 7, said passage 15 being formed in the wind-  
 40 chest sections 2 and 3 and separators 4 and 5 and extends through the upper wall of the striker-pneumatic 14, which is secured to the lower face of the wind-chest.

The flexible separator 4 forms the bottom  
 45 of the valve-board 1 and extends entirely across the bottom of said board and top of the wind-chest and also extends across the top of the exhaust-chamber 6. The portions of this separator 4 directly above the pockets  
 50 7 are provided with apertures in which are inserted annular metal rings 16, having their upper and lower edges crimped over and upon the upper and lower faces of the separator to form a valve-seat for a suitable valve  
 55 17. This valve 17 is made of wood or equivalent light material and normally rests upon the upper face of the metal valve-seat 16 and is provided with a depending stem 18 of the same material, and therefore integral with the  
 60 valve proper. The head or upper end of the valve is of greater diameter than the port 19 in the ring or valve seat 16, and its stem 18 extends downwardly through said port and is raised by the pneumatic 10 to permit the  
 65 air to pass through the port when the valve is

open and is sufficiently large to coact with the walls of the port 19 to guide the valve in its vertical movement and prevent its lateral displacement from its seat. The lower and  
 70 upper faces of the head of the valve are provided with yielding packings 20 and 21, of leather or equivalent material, which is glued or otherwise cemented to said head. The opening 13 in the top of the valve-board 1 is of slightly-greater diameter than the head of  
 75 the valve 17, so as to permit the valve to be readily inserted or removed therethrough when assembling the parts or when it is desired to make repairs to the valve or primary  
 80 pneumatic. This opening 13 is closed by a suitable cap 23, which is glued or otherwise secured to the top face of the valve-board with an interposed separator 24 of pasteboard or equivalent flexible material having  
 85 its opposite faces adhesively secured to contiguous faces of the valve-board and cap and its central portion yielding. A hollow metal bushing 25 is adjustably secured in a central opening in the cap 23 and has a central port  
 90 26 connecting the opening 13 and channel 12 with atmosphere, the lower end of said metal bushing 25 forming a metal valve-seat for the upper end of the valve 17. This bushing is preferably screw-threaded and is adjustable  
 95 endwise by rotation to determine the amount of movement of the valve 17, and thus regulate the rapidity of the action of the valve in closing the port 26, which also governs the speed of action of the key-operating  
 100 pneumatic. If at any time after the parts have been assembled, as previously described, it becomes necessary to have access to the valves, the cap 23 may be readily removed by simply inserting a suitable blade or prying  
 105 instrument into the edge of the separator 24 to pry or lift the cap from the valve-board, by which operation the pasteboard separator is simply split and the cap removed to permit inspection or repairs of the valve or interior  
 110 mechanism, after which the cap may be replaced by simply inserting a new paper washer or separator between the cap and valve-board and gluing the same in place.

The valve-board is usually made up complete with the pasteboard or equivalent bot-  
 115 tom secured thereto and equipped with the metal valve-seats 16, and this enables me to use a comparatively thin material for the bottom of the valve-board, which when assembled upon the wind-chest forms a light but  
 120 rigid partition between the exhaust-chamber 6 and channel 12 of the valve-board, so that the eyelet or metal valve-seat 16 can be set more securely in the pasteboard than would be possible in the wood, thus avoiding any  
 125 warping or check from climatic changes which would be possible with wood. This also obviates any liability of shrinkage of the stock away from the metal eyelet or valve-seat. Another great advantage of extending  
 130



the pasteboard separator 4 entirely across the whole width and length of the valve-board and wind-chest is that it permits a slight shrinkage or expansion of the parts by reason of its flexibility and avoids consequent checking and leakage of air. This same advantage applies to the separator 24 as a means of securing the cap 23 to the top of the valve-board.

It is now apparent that the essential features of my invention are, first, a valve and stem formed from a single piece of light material, as wood, and having the stem guided in a metal seat for the valve; second, providing the valve-board with a thin yielding or flexible body of pasteboard or equivalent material to which the valve-seat is secured and interposing this yielding flexible body between the valve-board and wind-chest to allow for the expansion of the wood parts engaged without causing any leakage of air; third, to provide the openings in the top of the valve-board with individual caps having therein an adjustable metal valve-seat and port opening to atmosphere and interposing between the cap and valve-board a yielding separator of pasteboard or equivalent material which may be readily split by a suitable instrument and the cap removed when it is desired to have access to the underlying valve or its operating-pneumatic.

The operation of my invention is believed to be well understood; but it may be briefly described as follows: Assuming that the duct 9 is connected to one of the ducts of the tracker-board over which the perforated music-sheet is passing and that the air is being partially exhausted from the chamber 6, as well as from the duct 9 and pocket 7, then as soon as a perforation in the music-sheet is registered with the tracker-board duct in communication with the duct 9, which allows the air to enter the pocket 7 at atmospheric pressure, the primary pneumatic 10 will be immediately elevated by reason of the lower pressure above the same, thus causing the valve 17 to close the port 26 and open the port 19, whereupon a partial vacuum is immediately produced in the key-operating pneumatic 14 through the medium of the channels 12 and 15. As soon as the duct 9 is closed against the entrance of the air the pressure at opposite sides of the pneumatic 10 becomes equal and the valve drops by gravity onto its seat 16, thus opening communication between the striker-pneumatic 14 and atmosphere through the medium of the passages 15, 12, and 26, thus distending said striker-pneumatic ready to repeat the operation. When the valve 17 and diaphragm 10 are normally at rest, a clear space is left between the lower end 18 and diaphragm to allow for a slight movement of the diaphragm from shrinkage or other causes without unseating the valve from the port 19,

thereby avoiding any leakage of air through said port when the parts are at rest.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus of the class described, a valve-board having an air-passage, and a thin layer of different material across the passage and adhesively secured to the valve-board, a metal eyelet through said layer for forming an air-port, and a valve guided in the eyelet.

2. In an apparatus of the class described, a wind-chest having an exhaust-chamber common to and inclosing a plurality of primary pneumatics, a comparatively thin body of pasteboard adhesively secured to the top face of the wind-chest and extending across the exhaust-chamber, and a valve-board adhesively secured to the top face of the pasteboard whereby the adhering surfaces are made rigid with each other while the intervening portion of the pasteboard yields under the uneven shrinkage or swelling of the valve-board and wind-chest.

3. In an apparatus of the class described, a valve-board, and a thin layer of cardboard or equivalent material adhesively applied to one face of the valve-board, and an eyelet through said layer forming an air-port.

4. In an apparatus of the class described, a valve-board of wood having a bottom of paper or equivalent material provided with a metal eyelet therethrough for forming an air-port.

5. In an apparatus of the class described, a wind-chest having an exhaust-chamber, in combination with a thin layer of pasteboard across the chamber and provided with a metal eyelet forming an air-port.

6. In an apparatus of the class described, a valve-board having a bottom of pasteboard or equivalent material provided with an eyelet which forms an air-port and valve-seat, in combination with a valve guided in the eyelet.

7. In an apparatus of the class described, a wind-chest having an air-chamber and a thin layer of yielding material extending across the chamber and provided with a metal eyelet which forms a port and valve-seat, and a valve guided in the eyelet.

8. In an apparatus of the class described, a wind-chest and a valve-board, in combination with a body of yielding material between the contiguous faces of the wind-chest and valve-board, an eyelet through said body and forming a port and a valve-seat, and a valve guided in the eyelet.

9. In an apparatus of the class described, a valve having a stem both formed of a single piece of wood, in combination with a metal eyelet receiving and guiding the stem.

10. In an apparatus of the class described, a primary pneumatic and a valve-board having a port opening to atmosphere, in combi-



nation with a partition between the primary pneumatic and port and itself provided with a port, a metal eyelet in the partition constituting a port and a valve-seat, and a valve 5 playing between the ports and having a stem guided in the eyelet and clear from the primary pneumatic.

11. In an apparatus of the class described, a metal eyelet constituting a valve-seat and 10 air-port, in combination with a valve of wood having a stem of the same material guided by the eyelet.

12. In an apparatus of the class described, two metal valve-seats each having a port, in 15 combination with a valve playing between the seats and having a stem in sliding engagement with the sides of one of the ports.

13. Two metal valve-seats each having an air-port and one being adjustable toward 20 and from the other, in combination with a wood valve having a stem of the same material guided in one of the ports.

14. In a pneumatic self-playing musical instrument, the combination of a one-piece 25 valve-board and a wind-chest inclosing a group of valves and primary pneumatics, said wind-chest having an exhaust-chamber common to all of the pneumatics, a comparatively thin body of pasteboard, or equivalent 30 material, interposed between and coextensive with the valve-board and wind-chest and provided with a series of openings there-through, one for each valve, metal valve-seats surrounding said openings, valves 35 guided in the metal valve-seats and primary pneumatics, one for each valve and normally out of operative connection therewith to permit a slight action of the primary pneumatic without effecting the operation of the valve.

15. In a pneumatic self-playing musical 40 instrument, the combination of a valve-board and wind-chest inclosing a group of valves and primary pneumatics for operating the same, said wind-chest having an exhaust-chamber common to all the primary pneu- 45 matics, metal eyelets forming ports communicating with said chamber, primary pneumatics, one for each port, and valves normally seated upon the eyelets and each having a stem guided in its eyelet, the distance 50 between each valve-seat and the valve-operating face of its primary pneumatic when the latter is in its normal position being slightly greater than the length of the valve-stem to allow a slight movement of the primary pneu- 55 matic independently of the valve.

16. In a pneumatic self-playing musical instrument, the combination of a one-piece valve-board and a wind-chest inclosing a 60 group of valves and their primary pneumatics, said wind-chest having an exhaust-chamber common to all of the primary pneumatics, a body of pasteboard or equivalent material interposed between and coextensive with the 65 adjacent faces of the valve-board and wind-chest and provided with a plurality of openings, one for each valve, a metal eyelet in each opening forming a port communicating with the exhaust-chamber, valves guided 70 in said eyelets and primary pneumatics, one for each valve, and normally out of contact therewith.

In witness whereof I have hereunto set my hand on this 30th day of July, 1904.

LEWIS BENJ. DOMAN.

Witnesses:

Mrs. THOMAS ELLIOTT,  
GEO. LARRABEE.