

**No. 676,031.**

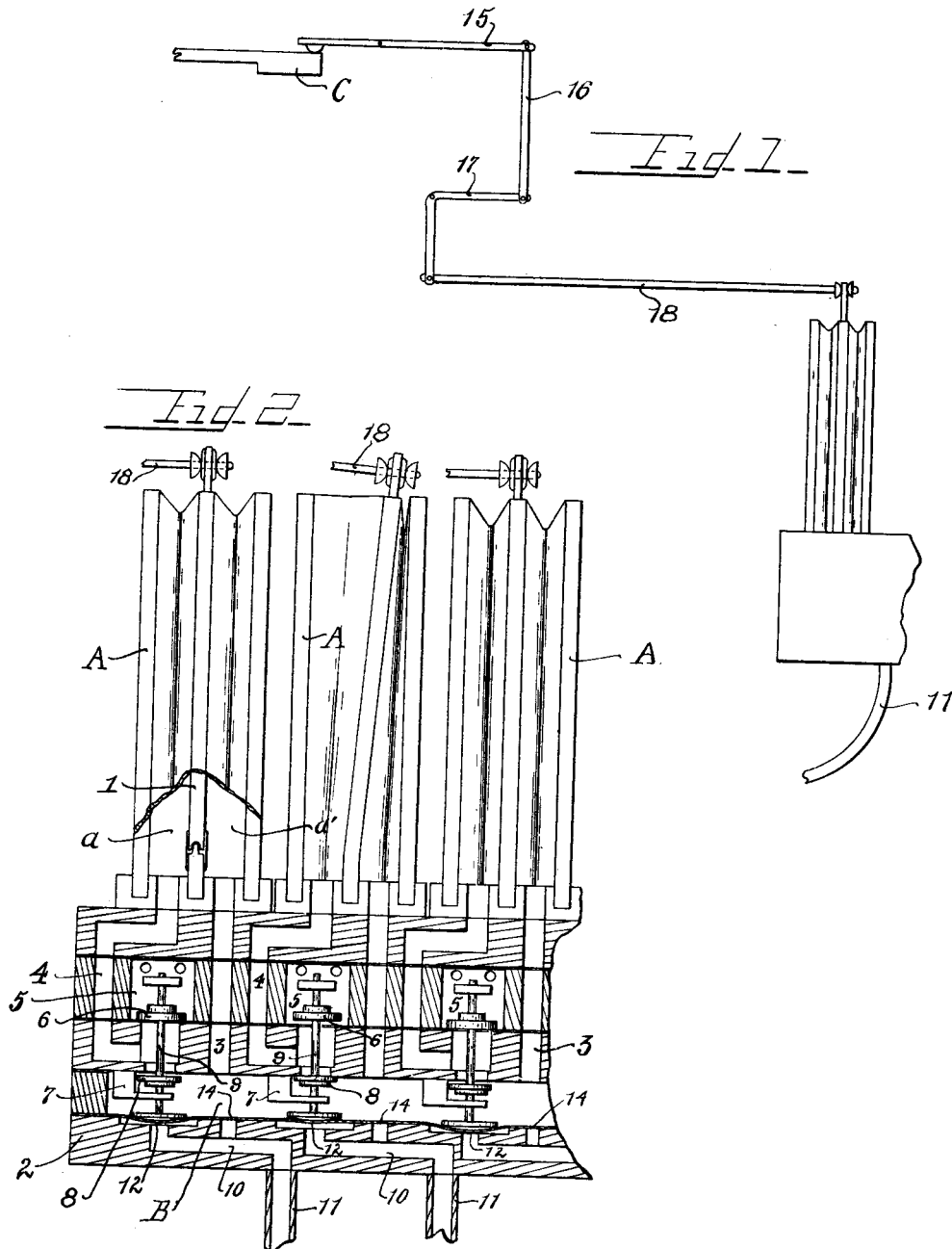
**Patented June 11, 1901.**

**C. L. DAVIS.**

**MECHANICAL MUSICAL INSTRUMENT.**

(Application filed Apr. 23, 1900.)

(No Model.)



Witnesses

C. E. Turner.  
May W. Zabel

Inventor  
CHARLES L. DAVIS

BY Charles A. Brown & Craft.  
Attorneys.

# UNITED STATES PATENT OFFICE.

CHARLES L. DAVIS, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SAID DAVIS AND AUGUST HEUER, JR., OF SAME PLACE.

## MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 676,031, dated June 11, 1901.

Application filed April 23, 1900. Serial No. 13,912. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES L. DAVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Mechanical Musical Instruments, (Case No. 2,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to mechanical musical instruments, and in particular to a variety thereof capable of playing a piano or like instrument and commonly known as a "mechanical piano-player."

The invention relates especially to the pneumatic apparatus by which the piano-key-actuating levers or fingers are operated as a result of admission of air into the tracker-board ports of the apparatus.

The principal object of my invention is to secure an exceedingly quick, accurate, and effective stroke of the key-actuating finger or lever and an instantaneous return movement of the same.

To the attainment of the foregoing and other desired ends my invention consists in matters hereinafter set forth.

In the accompanying drawings, Figure 1 is a view of a portion of an apparatus embodying my invention and of connections for operating the piano-key thereby. Fig. 2 is a view, partly in section and partly in elevation, of the pneumatic apparatus illustrated in Fig. 1 on a larger scale.

In Fig. 2 of the drawings I have shown a bank or set consisting of three pneumatics for operating three piano-keys. It will be understood that the three pneumatics shown are arranged in this way merely as a desired arrangement for banking them together, so as to economize space, and that behind them are other banks of three each to the number required to operate the desired number of piano-keys.

The apparatus for actuating each key involves a bellows A or other pneumatic, having two chambers *a* and *a'* and a swinging member actuated by the difference in pressure in these chambers—in this case a lever

or flap 1. As a preferred arrangement this leaf or flap 1 is arranged directly between the air-chambers *a* and *a'*, as shown in the figures.

In the way now best known to me for carrying out my invention I normally maintain an equilibrium of pressure in the two chambers *a* and *a'*, preferably a vacuum or partial vacuum of the same degree in both chambers. The flap 1 then stands in a middle position, as shown by the two end pneumatics in Fig. 2. When the pneumatic is to be operated, the air-pressure is varied in one of its chambers or sides, so as to disturb or destroy the equilibrium normally existing in such chambers. In case the equilibrium is maintained by a vacuous condition of the same degree in both chambers, I destroy such equilibrium by admitting air into one of the chambers. In such case the flap will swing to one side, as shown by the position of the flap in the middle pneumatic in Fig. 2, it being understood that air has been admitted to the left-hand chamber of that pneumatic to cause its flap to swing to the right. After the pneumatic has been operated by this destruction of the equilibrium in the two air-chambers such equilibrium is again restored. The flap 1 then returns to its middle position, and thereby restores the pneumatic to its normal condition. This restoration of the flap to its normal position I believe to be due to the fact that when it is swung to one side the air-pressure from the outside is greater upon the stretched portion of the bellows material—that is to say, the left-hand portion of the material in the middle pneumatic in Fig. 2—than upon the collapsed portion of the bellows material. This preponderance of atmospheric pressure upon the stretched portion has a tendency to collapse that portion, and this effect is not counterbalanced by the atmospheric pressure upon the collapsed material of the other side of the bellows. The result is that the flap will be drawn in a direction to restore it to its middle position. Should it swing by the middle position, a preponderance of atmospheric pressure will take place upon the other bellows material and the flap will be returned a slight extent in an opposite direction. This

vibration of the flap continues until it assumes a balanced condition in its middle portion. Whether this be the correct interpretation of the action of the pneumatic or not, it is nevertheless a fact that the flap 1 does automatically restore itself to its middle or normal position as soon as a condition of equilibrium is restored in the two sides or chambers of the pneumatic. As a result of this arrangement I procure a pneumatic which is exceedingly quick and effective in its action and which is instantaneously self-restoring.

As an arrangement for maintaining an equilibrium of reduced pressure between the two chambers or sides of the pneumatics, I provide them with passages 3 3 3, which extend from their right-hand sides or chambers *a' a' a'* to the exhaust chamber or chest B, which is understood to be suitably connected with the bellows or other exhaust apparatus in the instrument. This exhaust chest or chamber B is suitably formed in a casing or box 2, which serves as a supporting structure for the pneumatics A A. The other sides *a a* of the pneumatics A A are also connected with the exhaust chamber or chest B by passages 4 4 4, likewise extending between the sides *a a* of the pneumatics and said exhaust chamber or chest. From this it will be obvious that both sides of the pneumatics are normally in communication with the same exhaust chamber or chest, and that they therefore both have the same degree of vacuum or partial vacuum. Air is admitted into the sides *a a* of the pneumatics from suitable air chambers or trunks 5 5 5, likewise formed in the casing or box 2. Air is admitted into the passages 4 4 4 by valves 6 6 6, controlling ports in the passages 4 4 4 opening into the air-trunks 5 5 5. The ports of the passages 4 4 4, which open into the exhaust chamber or chest B, are also provided with valves 8 8 8, which, with the valves 6 6 6, are carried by valve stems or spindles 9 9 9, arranged so that when the air-port of the passage 4 is closed by its valve 6 the exhaust-port of that passage will be opened by its valve 8, and vice versa. The valve-spindles 9 9 are supported by supports or guides 7 7. By this arrangement it will be seen that when one of the valve-spindles is in a lowered position the corresponding passage 4 will be closed to the corresponding air-trunk 5 and opened to the vacuum-chamber B, whereby an exhaust or vacuum condition will be maintained in the side air-chamber *a* of the corresponding pneumatic. This is the normal condition of the arrangement and is indicated by the positions of the valves and valve-spindles in the two end pneumatics in Fig. 2. It will also be seen that when the valve-spindle is in an elevated position the air-port of its passage 4 is open to the corresponding air-trunk 5 and the vacuum-port of that passage is closed to the vacuum chamber or chest B, whereby air will be admitted to the cham-

ber *a* of that pneumatic. It will thus be seen to comprise one arrangement or mechanism for maintaining an exhaust or vacuum equilibrium in the two chambers of each pneumatic and also for admitting air into one of the same.

In the use of pneumatics of this kind in a mechanical piano-player or like instrument I have shown as one arrangement for elevating the valve-spindles 9 9 9 to operate the respective pneumatics diaphragms 12 12 12, arranged at the ends of passages 10 10 10, which communicate with the interior of the tubes or pipes 11, which are understood to extend to the various ports of the tracker-board. By such arrangement when air is admitted to one of the tracker-board ports and the corresponding tube or pipe 11 the diaphragm 12 at the end of that tube or pipe will be forced upwardly, so as to lift the valve-spindle resting upon it, and thereby admit air into the passage 4 of the corresponding pneumatic.

The diaphragms 12 12 are provided with bleeders 14 14, through which the air can be exhausted from the passages 10 10 and tubes 11 11 when it is shut off from the corresponding tracker-board ports. At such times the diaphragms 12 12 will collapse and allow the valve-spindles 9 9 to descend, whereupon the chambers *a a* of the pneumatics will be again cut off from the air-ducts and placed in communication with the vacuum-chamber. As illustrative of one arrangement which can be employed in the operation of the mechanical piano-player to play the piano I have shown in Fig. 2 mechanism whereby the actuation of the pneumatic will operate to strike the piano-key C. This mechanism comprises a finger 15 for striking a piano-key, a link 16 for operating the finger 15, a bell-crank 17, having arms connected to the link 16, and a rod 18, having one end connected to the lower arm of the bell-crank 17 and the other end connected to the upper end of the flap 1. By such arrangement a movement of the flap or leaf 1 to the right will cause the rod 18 to swing the bell-crank 17, so as to elevate the link 16 and swing the rear end of the finger upwardly, and thereby cause its forward end to strike and depress the piano-key C.

It will be seen that the pneumatic herein illustrated is simple and inexpensive. It has shown itself to be exceedingly quick and effective in its operation—so much so that by it the most difficult passages and trills can be played when it is used in a mechanical piano-player.

It will be understood that this pneumatic can be used in various ways other than that herein shown. I do not, therefore, wish to limit myself to its use in a mechanical piano-player.

What I claim as my invention is—

1. The combination with a double-chambered collapsible pneumatic, of means for varying the pneumatic pressure in one chamber

of said pneumatic, and means for maintaining a uniform pressure in the other chamber, substantially as set forth.

2. The combination with a collapsible pneumatic or bellows having two chambers; of means for maintaining a pneumatic equilibrium in the two chambers; and means for varying the pneumatic pressure in one chamber only so as to destroy the equilibrium between the two chambers.

3. The combination with a collapsible pneumatic or bellows having two chambers; of means for maintaining an exhaust or vacuum condition of the same degree in both chambers; and means for admitting and exhausting air from one only of said chambers.

4. The combination with the bellows, having two chambers and with an exhaust-chest and an air-trunk; of a normally open passage establishing communication between one side or chamber of the bellows and the exhaust-chest; another passage leading from the other side or chamber of the bellows and having ports opening into the air-trunk and the exhaust-chest; and valve mechanism for opening the air-port in the last-mentioned passage, and simultaneously closing the exhaust-port thereof, and vice versa.

5. The combination with the bellows or pneumatic having two chambers, and with an air-trunk and an exhaust-chest; of a normally open passage establishing communication between the exhaust-chest and one side or chamber of the bellows; another passage extending from the other side of the bellows and having ports opening into the air-trunk and the exhaust-chest; valve mechanism for controlling said ports, said mechanism being arranged to normally close the port to the air-trunk and to open the port to the vacuum-chamber; a tracker-board passage; means for operating said valve mechanism so as to open said port to the air-trunk and close the port to the vacuum-trunk upon the admission of air into the tracker-board passage.

6. The combination with the collapsible pneumatic or bellows having two chambers, and the exhaust and air ducts or chambers, and also with the tracker-board and a passage leading therefrom to the pneumatic; of means for normally maintaining a corresponding exhaust condition in both sides or chambers of the pneumatics; and means for admitting air into one side or chamber thereof upon the admission of air into the tracker-

board passage, and for exhausting air from such side or chamber upon the closure of such tracker-board passage.

7. The combination with the bellows or pneumatic having two chambers, and with the air-trunk and exhaust chest or chamber; of a normally open passage establishing communication between one side or chamber of the bellows and the exhaust chest or chamber; another passage extending from the other side or chamber of the bellows and having ports opening respectively into the air-trunk and exhaust chest or chamber; a valve-spindle carrying a couple of valves which are arranged to open the exhaust-port and close the air-port of said passage, and vice versa; a diaphragm arranged to actuate the valve-spindle; a tracker-board passage terminating at said diaphragm so that the admission of air to the tracker-board passage will actuate the diaphragm and thereby the valve-spindle; and a bleeder-port in the diaphragm, substantially as described.

8. The combination with the piano-key-actuating finger; of a collapsible pneumatic having two sides or chambers, and also having a swinging member; mechanism between said finger and swinging member, whereby the operation of the latter will actuate the finger, the exhaust chambers or passages; means for maintaining an exhaust condition in both sides or chambers of the bellows; a tracker-board and tracker-board passage; and means for admitting air into one side or chamber of the bellows upon admission of air into the tracker-board passage, and for exhausting the same therefrom upon the closure of the tracker-board passage.

9. The combination of a collapsible pneumatic having rigid side walls and a swinging member arranged between said walls so as to divide the pneumatic into two chambers, the said swinging member being attached to the collapsible material extending between the rigid side walls, means for varying the pneumatic pressure in one of the chambers formed by said swinging member, and means for maintaining a uniform pressure in the other chamber, substantially as set forth.

In witness whereof I hereunto subscribe my name this 14th day of April, A. D. 1900.

CHARLES L. DAVIS.

Witnesses:

A. MILLER BELFIELD.

CHARLES E. HUBERT.