

No. 675,468.

Patented June 4, 1901.

C. L. DAVIS.

ACTION FOR PNEUMATIC MUSICAL INSTRUMENTS.

(Application filed Aug. 15, 1900.)

(No Model.)

Fig. 1.

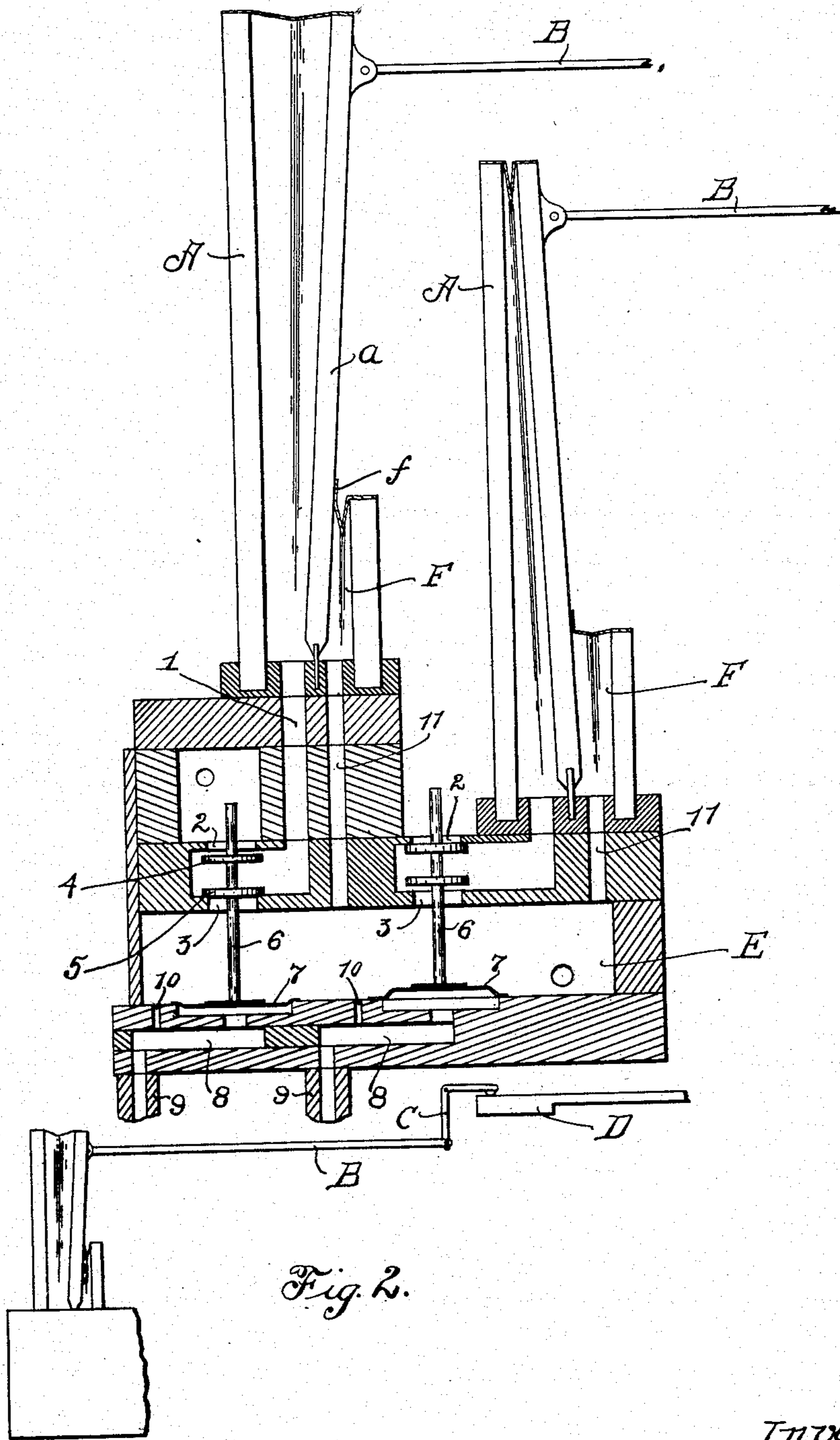


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ACTION FOR PNEUMATIC MUSICAL INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 675,468, dated June 4, 1901.

Application filed August 15, 1900. Serial No. 26,992. (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 Actions for Pneumatic Musical Instruments, (Case No. 4,) 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 actions by which a positive stroke can be secured in pneumatic musical instruments—such, for example, as mechanical piano-players. Although the invention is capable of use in substantially any pneumatic musical instrument, I have shown it embodied in an arrangement for operation in a mechanical piano-player, and hence will describe it in connection with that instrument, although I do not desire to be limited in its application thereto.

In mechanical musical instruments such as are adapted to operate a piano or other instrument having a keyboard it is well known that the mechanical musical instrument is provided with a series of operating-fingers which are arranged in connection with and above the keys of the piano or like instrument when the mechanical musical instrument is placed in position in front of a piano, so as to operate the same. These key-actuating fingers of the musical instrument are connected with a series of pneumatic-actions, or "pneumatics," as they are commonly called, each one of which is arranged for operating one of the keys. The pneumatic-actions are generally actuated so as to actuate their respective fingers by the variation in the pneumatic pressure in their interiors. A common way of bringing this about is to connect each one with one of a series of ports in what is known as a "tracker-board," so that the admission of air into those ports will cause the actuation of the corresponding pneumatics. The admission of air into the tracker-board ports is controlled by a traveling sheet of music having perforations adapted to register with the ports of the board. These perforations are so situated that they come into register with the tracker-board ports at proper

times to cause the actuation of the pneumatics controlling the keys which are to play the musical composition. In this way the proper keys are played at the proper time by the fingers of the mechanical musical instrument, so as to play various musical compositions.

The invention of the present application relates in particular to the pneumatics or pneumatic-actions by which the key-actuating fingers of the mechanical piano-player are controlled.

The principal objects of the invention are to secure a quick, rapid, decisive, and effective stroke of the key-actuating fingers and to procure this result by simple, inexpensive, and practical means.

In the accompanying drawings, Figure 1 is a view, partly in elevation and partly in section, of a pneumatic or pneumatic-action embodying my invention. Fig. 2 is an elevation of the same, showing its connection and arrangement in a mechanical piano-player for operating one of the fingers of a piano or like instrument.

In the arrangement illustrated in the drawings I provide a series of pneumatics or bellows A A for actuating the fingers of the piano-player, one pneumatic being arranged for each finger. These pneumatics are conveniently provided with links B B, and the ends of the links B B are connected with bell-cranks C C, whose opposite arms are arranged and adapted to strike the piano-keys D D. The pneumatics or bellows A A are understood to be sufficiently strong to give an effective and decisive stroke to the piano-keys through the agency of the mechanism illustrated. Each of the pneumatics A A is provided with a passage 1, shown as leading downwardly therefrom and having at its opposite end ports 2 and 3. The ports 2 communicate with the outside atmosphere and the ports 3 communicate with a vacuum-chamber E, which is understood to be connected with a pressure-reducing apparatus. The ports 2 and 3 of each pneumatic are controlled by valves 4 and 5, both of which are shown arranged upon the same valve-spindle 6. When the valve-spindle 6 is in a lowered position, as shown in the left-hand pneumatic in Fig. 1, the port 2 is opened and the port 3

closed, thereby closing the pneumatic to the normal air-pressure and opening it to the vacuum-chamber or to an air-pressure lower than the normal atmospheric pressure. The ends of the valve-spindle 6 6 are attached to diaphragms 7 7, and these diaphragms 7 7 are arranged over the ends of the passages 8 8, leading from various tracker-board ports. It is understood that the tubes 9 9 (shown in the drawings) lead to the tracker-board and that their ends form continuations of various tracker-board ports. The diaphragms 7 7, it will be observed, are arranged in the vacuum-chamber E, so that when air is admitted to one of the tracker-board ports it will upon entering the passage 8 stretch the corresponding diaphragm 7, and thereby throw the valve-spindle 6 thereof upwardly and close the air-port 2 and open the vacuum-port 3. This will open the interior of the pneumatic A to the exhaust-chamber E, and thereby permit the air in the pneumatic to be withdrawn. As a result the outside atmosphere will act upon the exterior of the pneumatic and collapse the same, so as to cause a quick and decisive stroke of the connected key-actuating finger. When the air-pressure is shut off from the tracker-board port by the traveling sheet of music, the air remaining therein is withdrawn therefrom and from the passage 8 by a small bleeder-port 10, arranged alongside of the diaphragm 7. A condition of exhaust is thus established in the tracker-port passage and the diaphragm 7 collapses, thereby allowing the valve-spindle 6 to descend of its own weight and open the air-port 2 and close the exhaust-port 3. This allows the entrance of the outside air into the pneumatic A, and thus establishes therein a condition of equilibrium with the exterior atmosphere.

As an arrangement for returning the pneumatic A to its normal position I have shown a supplemental pneumatic F, arranged in connection with each pneumatic A. This pneumatic F is provided with a port 11, extending from its interior to the vacuum-chamber E and normally maintained in an open condition, so that there is always an exhausted condition within the pneumatic F. This supplemental pneumatic F is arranged so that it always tends to restore the pneumatic A to its original condition, a simple arrangement being to connect the collapsible material of the pneumatic F to the swinging leaf or flap  $\alpha$  of the pneumatic A, in which way the pneumatic F in tending always to collapse exerts continually a pressure or force tending to swing the flap  $\alpha$  back to its normal position. The pneumatic F, however, is considerably weaker than the pneumatic A, as by making it considerably smaller relatively thereto, so that the pneumatic A can act in opposition to the supplemental pneumatic F when the former is exhausted as a result of the admission of air into its tracker-board port. By this arrangement it will be seen that when air is admitted to one of the tracker-board ports and

a condition of exhaust is established in the pneumatic A as a result thereof this pneumatic will act quickly and powerfully in opposition to the pneumatic F, but that when the air is shut off from that tracker-board port and a condition of equilibrium is established in the pneumatic A as a result thereof the supplemental pneumatic F will immediately act to restore the pneumatic A to its original condition. These acting and return strokes are made rapidly, quickly, and effectively. It will be also seen that when the primary pneumatic operates the supplemental pneumatic has less power relatively, because of the condition of equilibrium established between it and the main pneumatic. It will be further seen that the arrangement illustrated is simple, inexpensive, and practical and that it involves a minimum number of parts—that is to say, a single large pneumatic and a single valve mechanism.

Although I have thus described a specific structure shown in the drawings, I do not desire it to be considered that I wish to limit myself either to that specific structure or to the specific embodiment of the invention which it entails. I am fully aware that the specific structure can be varied and also that the principle of the invention as contained therein can be carried out by structures varying very materially in arrangement and operation.

What I claim as my invention is—

1. The combination with main and supplemental pneumatics, of means for maintaining the atmospheric pressure normally in the main pneumatic, means for exhausting the air from such pneumatic as desired, and means for maintaining a vacuum constantly in the supplemental pneumatic, substantially as set forth.

2. A pneumatic-action comprising a pneumatic combined with means whereby it can be actuated by pneumatic pressure, and a supplemental pneumatic tending normally to restore the first-mentioned pneumatic to its original condition, the second pneumatic being relatively weaker than the first-mentioned one, whereby the latter can operate in opposition to the former.

3. In a pneumatic-action, the combination with a pneumatic, of valve mechanism for controlling the admission and exhaust of air therefrom, and a supplemental pneumatic tending normally to restore the first-mentioned pneumatic to its original condition, the supplemental pneumatic being relatively smaller than the first-mentioned pneumatic, whereby the latter can operate in opposition to it.

4. In a pneumatic-action, the combination of a pneumatic having a passage leading therefrom, the said passage being provided with air and exhaust ports, valve mechanism controlling said ports so as to normally admit air under atmospheric pressure to the interior of said pneumatic, and a supplemental pneu-

matic relatively weaker than the first-mentioned one, the said supplemental pneumatic having a passage normally and continuously establishing communication between its interior and the said exhaust-chamber.

5. In a pneumatic-action, the combination with a pneumatic, of means for maintaining a condition of equilibrium therein, means for varying said condition so as to cause the pneumatic to act, a supplemental pneumatic relatively weaker than the main pneumatic, and means for maintaining in the supplemental pneumatic a pneumatic condition tending to cause it to actuate the main pneumatic.

6. In a pneumatic-action, the combination of a main and a supplemental pneumatic, the latter being relatively smaller than the former and having its collapsible material attached to the movable member of the main pneumatic, an exhaust-chamber, passages leading from said pneumatics, the passage from the main pneumatic having a port terminating at said exhaust-chamber and another port communicating with the outside atmosphere and the passage leading from the supplemental pneumatic terminating at said exhaust-chamber, a valve-spindle carrying valves respectively controlling the ports of said primary-pneumatic passage, a diaphragm attached to said valve-spindle and arranged in the exhaust-chamber, a tracker-board port terminating at said diaphragm, and a bleeder-port establishing communication between the exhaust-chamber and the tracker-board passage.

7. The combination with main and supple-

mental pneumatics and with a vacuum-chamber, of a passage extending from the main pneumatic and having an air-port and a port opening into said vacuum-chamber, valve mechanism for controlling said ports, means for maintaining said valve mechanism in such condition as to normally close the vacuum-port and open the air-port, means for shifting said valve mechanism so as to open the vacuum-port and close the air-port, and a passage extending from the supplemental pneumatic to the vacuum-chamber, said passage being constantly open, substantially as set forth.

8. A pneumatic-action, comprising a structure consisting of a pair of side walls, flexible material extending between said walls, a member arranged between the walls and attached to the flexible material so as to divide the space between the walls into two chambers, the said member and the side walls being relatively movable, means whereby the atmospheric air normally communicates with the interior of one of such chambers, mechanism by which the air can be withdrawn from such chamber as desired, and means for constantly maintaining a vacuous condition in the other one of said chambers, substantially as set forth.

In witness whereof I hereunto subscribe my name this 7th day of August, A. D. 1900.

CHARLES L. DAVIS.

Witnesses:

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HARVEY L. HANSON.