

No. 822,098.

PATENTED MAY 29, 1906.

C. S. BURTON.

EXPRESSION CONTROLLING DEVICE FOR MUSICAL INSTRUMENTS.

APPLICATION FILED AUG. 1, 1904.

2 SHEETS—SHEET 1.

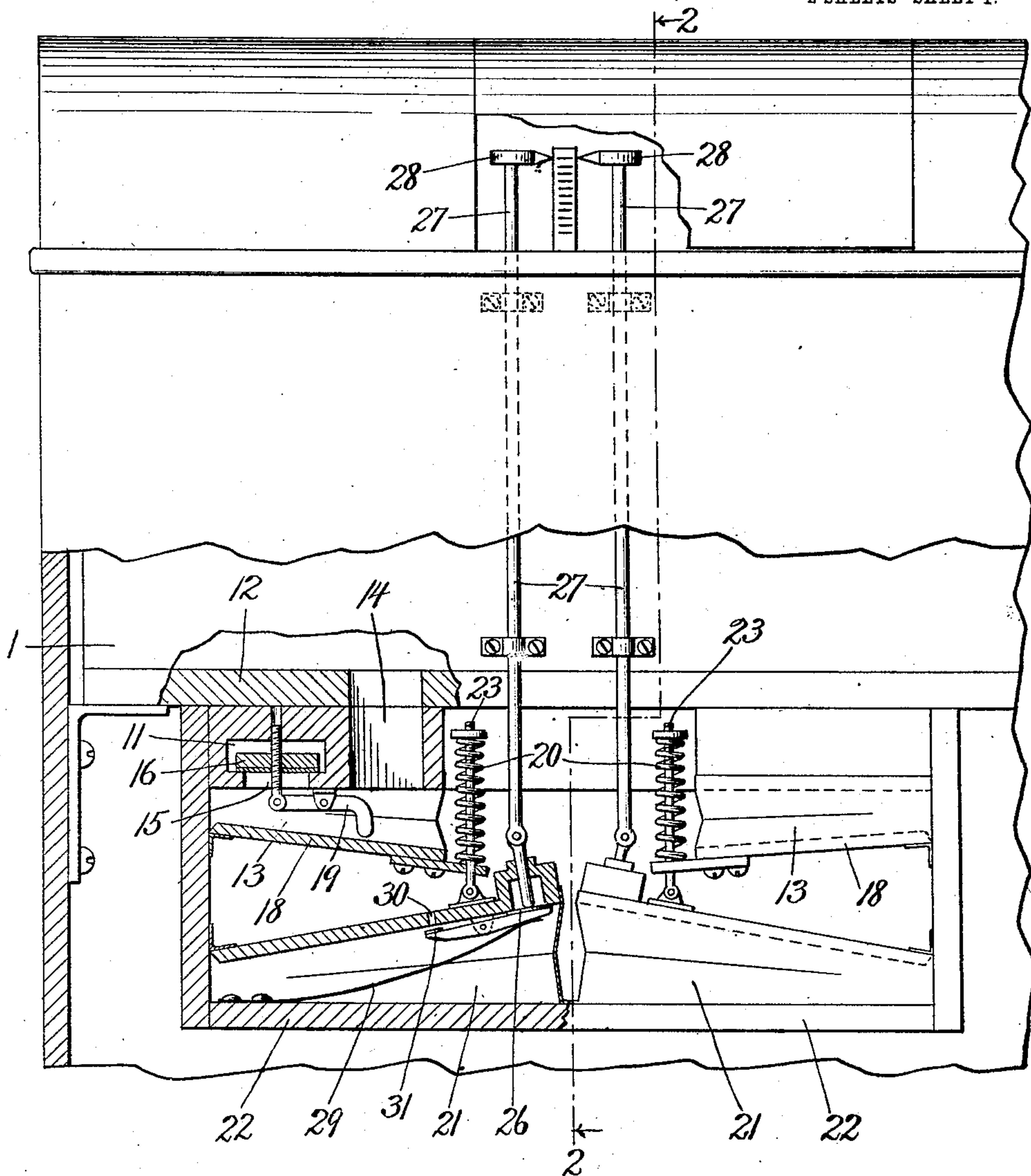


Fig. 1.

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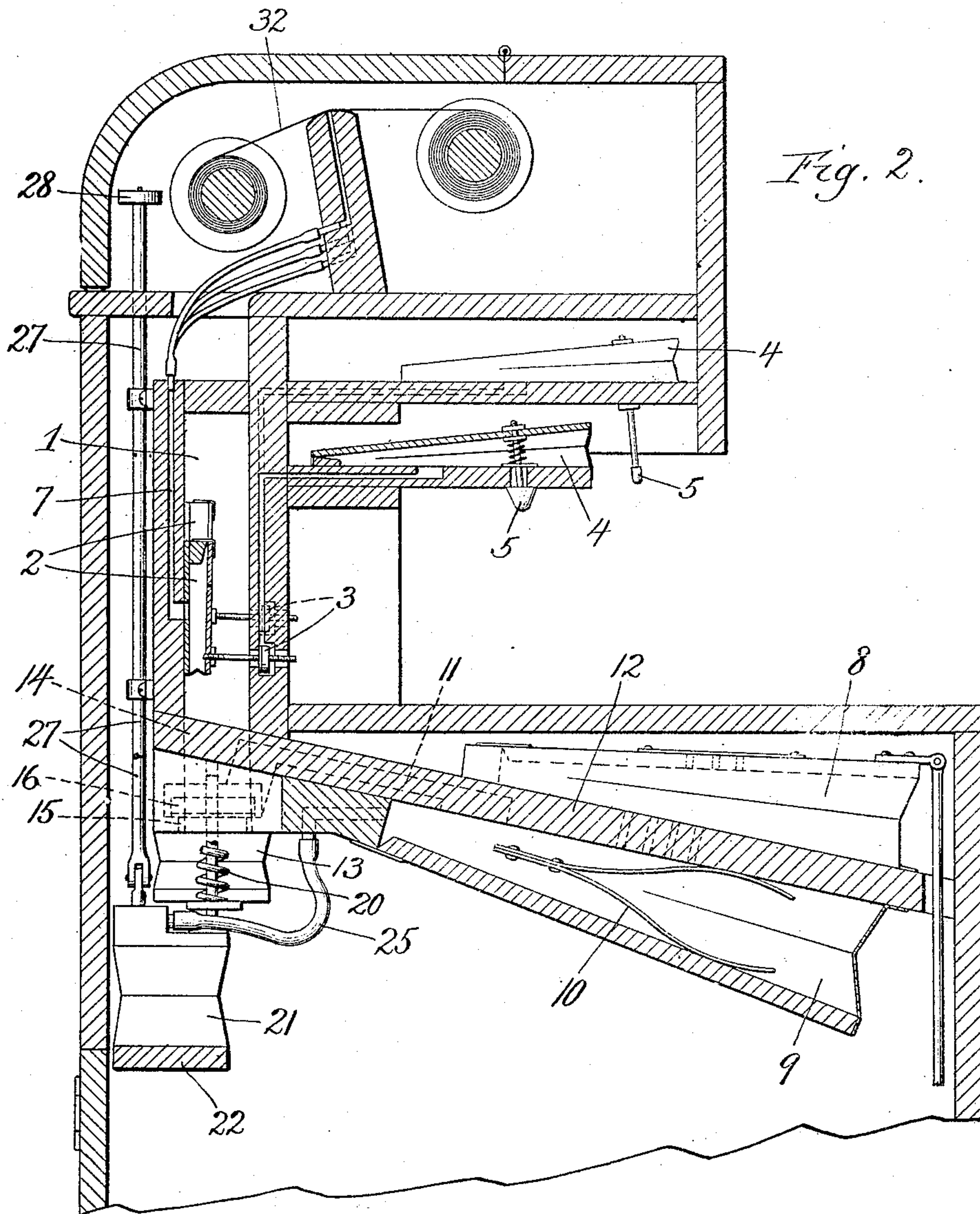
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# UNITED STATES PATENT OFFICE.

CHARLES S. BURTON, OF OAK PARK, ILLINOIS.

## EXPRESSION-CONTROLLING DEVICE FOR MUSICAL INSTRUMENTS.

No. 822,098.

Specification of Letters Patent.

Patented May 29, 1906.

Application filed August 1, 1904. Serial No. 219,047.

*To all whom it may concern:*

Be it known that I, CHARLES S. BURTON, a citizen of the United States, residing at Oak Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Expression - Controlling Devices for Musical Instruments, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide more efficient means than have hitherto been commonly employed for regulating the expression or loudness and softness of tone in an automatic musical instrument or player.

It consists of the features of construction set out in the claims.

In the drawings, Figure 1 is a partly-sectional front elevation of a portion of an automatic player embodying my improvements. Fig. 2 is a section at the line 2 2 on Fig. 1.

I have shown my invention as applied to a familiar form of pneumatic action for an automatic player in which an air-chamber 1 is connected with means for maintaining therein an exhaust tension or rarefied condition of air and in which there are located primary pneumatics 2 for operating valves 3, which control the motor-pneumatics 4 for operating the strikers 5, which operate upon the keys of the instrument to be played in a manner well understood, said valves 3 being moved by the primary pneumatic for putting the motor-pneumatic in communication either with the exhaust tension or rarefied air in chamber 1 or with the atmosphere, the latter being what may be called the "normal" condition of the motor-pneumatic, and causing it to be fully expanded to uphold the striker, and the condition of communication of the motor-pneumatic with the air-chamber 1 being produced when the primary pneumatic is inflated, and such inflation being caused by admitting the outer air to the primary pneumatic through the tracker-ducts 7, controlled by the customary perforated sheet 32, and the effect of such communication of the chamber 1 with the motor-pneumatic being the collapse of the latter, causing its striker to strike the key to be sounded corresponding to the particular tracker-duct, the opening of which causes such action of the motor-pneumatic. It is well understood that the

force of the blow struck by the collapse of the motor-pneumatic when it is put in communication with the chamber 1 depends upon the degree of exhaust tension in said chamber, and the purpose of my invention is to regulate this exhaust tension in a perfectly-graduated manner and at the will of the operator from the least which will cause the motor-pneumatic to strike the softest blow which will produce any sound to the greatest which can be produced by the means provided for that purpose. The exhaust tension is produced by customary pumping-bellows 8, exhausting the air from the main exhaust bellows or equalizer 9, which is calculated to maintain, in any chamber with which it may be freely connected, a degree of exhaust tension measured by the tension of the spring 10, which operates to keep said receiving-bellows distended and resists its collapse, which the action of the chambers tends to cause. The equalizer or main exhaust-bellows 9 is in communication with the air-chamber 1 through a passage 11 in the foundation-board 12, on the under side of which the bellows 9 is mounted and which forms one side of the bellows-chamber; but said passage 11 does not lead directly from the bellows 9 to the chamber 1, but into a pneumatic or small valve-operating bellows 13, which is also mounted upon the under side of the foundation-board and conveniently in the position shown—in front of the forward or hinged side of the bellows 9 directly under the chamber 1—and from said pneumatic 13 there is an open throat 14 through the foundation-board which leads up into said chamber 1. At the upper side of the port 15, by which the passage 11 communicates with the pneumatic 13, and within the passage 11 there is a valve 16, which seats downwardly to close said mouth 15 and is operatively related to the vibrating leaf 18 of the pneumatic 13 through the medium of a lever 19, pivoted so as to cause the valve 16 to be drawn to its seat by the collapse of the pneumatic. Said vibrating leaf is exposed to the action of a tension-spring 20, which to the extent of its tension tends to hold the pneumatic 13 expanded, and thereby to leave the valve free to move off its seat at the port 15 for passage of air inward—that is, toward the chamber 1. The result, however, of opening communication



from the bellows 9 to the pneumatic 13 is to collapse the pneumatic, and such collapse seats the valve 16. It will be seen, therefore, that the tension of the spring 20 determines the exhaust tension which can be produced in the chamber 1 by means of its communication with the exhaust-bellows or equalizer 9, and that any admission of air to the chamber 1 through the motor-pneumatics when they are brought into action for sounding a note by tending to diminish the exhaust tension in the chamber 1 causes the valve to open just until the exhaust tension is restored to the degree determined by the spring 20, and thus in the continuous operation of the instrument for playing the valve 16 will vibrate on and off its seat, barely opening and closing as the air is drawn into the chamber 1 from the motor-pneumatics in performing their function.

Any means by which the tension of the spring 20 can be put under the control of the operator will put under his control also the force by which the motor-pneumatics operate and strike the keys of the instrument.

Any mechanical connections may be employed for tensioning the spring 20 at will, and such expedients would be within the generic scope of my present invention; but in practical operation it is desirable for the operator to control the tension by a single finger, so that with two fingers he may control such tension for two different sections of the instrument, as bass and treble, and the muscular effort necessary to do this if it involved tightening and holding at any desired tension a spring sufficiently strong to induce the necessary maximum tension in the chamber 1 might be quite severe and might constitute a practical objection to such devices.

To avoid this difficulty, therefore, I provide means for utilizing the pneumatic force which may be derived from the exhaust-bellows 9 to the tensioning of the spring 20, and for this purpose I employ what I term an "expression-pneumatic" 21, which is mounted above a fixed cross-bar 22 and has its upper leaf vibrating and connected to the rod 23, which extends through the spring 20 and is provided at the upper end with a stop thereon for compressing the spring as the rod is drawn down, which will be effected by the collapse of the expression-pneumatic. This expression-pneumatic is in communication with the exhaust-bellows 9 by a duct 25, which leads into said expression-pneumatic through the oscillating or vibrating leaf of the latter. Its mouth at the inner side of said leaf within the expression-pneumatic is closed by a valve 26, whose stem extends out through the leaf and is connected with a stop-rod 27, surmounted by a button 28 in proper position to be depressed by the operator. A spring 29 within the expression-pneumatic tends to

hold the valve 26 seated. When the operator depresses the stop-button, the valve 26 will be initially forced off its seat; but the result of such opening of the valve being to expose the motor-pneumatic to the exhaust tension through the duct 25 from the bellows 9 the expression-bellows will be immediately collapsed a little; but such collapse will cause the valve 26 to be again seated, cutting off communication between the main bellows 9 and the expression-bellows, because as the movable leaf of the bellows descends it carries the valve 26 away from the end of the stop-rod 27, permitting the spring 29 to close the valve 31. Whatever movement the upper leaf of the expression-bellows has made while the valve was open will have compressed the spring 20 and to the extent of such compression increased the tension operating to hold the pneumatic 13 expanded and to determine the exhaust tension operative in the chamber 1, and if the operator continues to depress the button 28 the moving leaf of the expression-pneumatic will continue to descend, said pneumatic being closed by the suction from the bellows 9; but wherever the operator ceases to depress the stop-button, at that point the collapse of the expression-pneumatic ceases and the tension of the spring 20 is thereby correctly determined by the position at which the operator holds the button 28, but without imposing upon the operator the necessity for the muscular exertion required to thus tension the spring, this action being performed by the expression-pneumatic, which may be made of sufficient area to produce any desired tension in a spring of any desired capacity. If the expression-pneumatic were absolutely air-tight, it would remain collapsed to the extent resulting from any depression of the button 28 and the button would not follow the operator's finger upward for diminishing the tension; but any suitable vent or leak-port being provided in the expression-pneumatic it will fill from the outer air whenever the valve 26 is seated, as it will be instantly upon the operator's relieving the pressure upon the button 28. A simple leak-port, such as is common and familiar for like purpose in primary pneumatics in this class of devices, may be employed at any convenient point; but since the expression-pneumatic may sometimes be of considerable size and since it should be adapted to become inflated quickly, and thereby adapted to effect rapid changes of expression, I prefer to make a leak-port or vent 30 in the vibrating leaf of the expression-pneumatic of considerable size; but it is prevented from causing excessive waste of air by means of a throttle-valve 31, which is connected to the valve 26, so that when the valve 26 is seated the valve 31 is off its seat and the leak-port 30 is open.



permitting the expression-pneumatic to fill quickly for expansion; but when the valve 26 is forced off its seat by depression of the button 28 the valve 31 is moved toward its seat. In practice any quick depression of the stop-button 28 will open the valve 26 enough to completely close the valve 31 before the collapse of the pneumatic overtakes the valve 26, and in practice, therefore, a very free vent may be made through the leak-port 30 without any continuous waste of air resulting therefrom.

I claim—

1. An automatic musical instrument or player having pneumatically-operated playing devices and an air-chamber from which is derived the pneumatic tension for operating said devices; a pneumatically-operated valve for governing the tension, means for causing yielding resistance to its action, a pneumatic operatively connected with said means for modifying the resistance by collapse and expansion of the pneumatic, and means for governing the collapse and expansion of said pneumatic at will.

2. An automatic musical instrument or player having pneumatically-operated playing devices and an air-chamber from which is derived the pneumatic tension for operating said devices and; a pneumatically-operated valve for governing the tension; means for causing yielding resistance to its action; a pneumatic operatively connected with said means for modifying the resistance by collapse and expansion of the pneumatic; a valve which controls said pneumatic and a stop for operating said valve at will.

3. An automatic musical instrument or player having pneumatically-operated playing devices and an air-chamber from which is derived the pneumatic tension for operating said devices; a pneumatically-operated valve for governing the tension; means for causing yielding resistance to its action; a pneumatic operatively connected with said means for modifying the resistance by collapse and expansion of the pneumatic; a valve which controls said pneumatic; a stop for operating said valve at will, said valve being mounted on the movable wall of the pneumatic and its opening movement being in the same direction as the collapsing movement of said moving wall.

4. An automatic musical instrument or player comprising, in combination with an exhaust-bellows or equalizer, an air-chamber in communication therewith; motor-pneumatics which are exhausted into said air-chamber; a pneumatic which is at all times exposed to the exhaust tension of said air-chamber; a valve which controls communication between the exhaust-bellows and the air-chamber operatively related to said pneu-

matic for being seated by the action of the latter which is caused by the exhaust tension of the air-chamber; means for yieldingly resisting such action; a pneumatic which communicates with the exhaust-bellows having its moving wall connected with said means for yielding resistance adapted for varying said resistance by its movement; a valve which controls the communication of the bellows with said last-mentioned pneumatic by moving relatively to said moving wall, and means for so moving it whose movement for opening the valve is in the same direction as the movement of said wall caused by such opening.

5. An automatic musical instrument or player comprising, in combination with an exhaust-bellows, an air-chamber communicating therewith and motor-pneumatics for operating the playing devices which are actuated for such operation by communication with the air-chamber; a pneumatic which constitutes part of the air-passage from the bellows to the air-chamber; a valve operatively related to the pneumatic for closing such passage when the pneumatic collapses; a spring which yieldingly resists such collapse; a second pneumatic having its moving wall connected with the spring for tensioning the latter when said second pneumatic collapses, said second pneumatic having communication through its moving wall with the exhaust-bellows; a valve which controls such communication adapted to be moved off its seat in the direction in which the moving wall moves in the collapse of the pneumatic, and a stop device for forcing the valve off its seat adapted to be moved to follow up the collapsing movement of said moving wall.

6. An automatic musical instrument comprising, in combination with an exhaust-bellows, an air-chamber in communication with the bellows; motor-pneumatics for operating the playing devices deriving their action by communication with said air-chamber; a pneumatic which constitutes part of the passage of communication between the exhaust-bellows and the air-chamber; a valve in said passage which is closed by the collapse of the pneumatic; a spring which yieldingly resists such collapse; a second pneumatic connected with said spring for tensioning the same when said second pneumatic collapses, said second pneumatic having communication through its moving wall with the exhaust-bellows; a valve which controls said communication mounted on and carried by the moving wall and adapted to be moved for opening in the direction in which the moving wall moves in the collapse of the pneumatic, said second pneumatic having a leak-port; a valve for closing such leak-port so connected to the valve which controls communication of said



pneumatic with the exhaust-bellows as to be seated when the latter valve is opened and opened when the latter valve is seated, and a stop device for opening said latter valve  
5 adapted to follow up the movement of said valve with the moving wall of the pneumatic.

In testimony whereof I have hereunto set

my hand, in the presence of two witnesses, at Chicago, Illinois, this 11th day of June, 1904.

CHAS. S. BURTON.

In presence of—

FRED. G. FISCHER,  
J. S. ABBOTT.