

E. WELTE.

PRESSURE CONTROLLING MECHANISM FOR AUTOMATIC MUSICAL INSTRUMENTS.

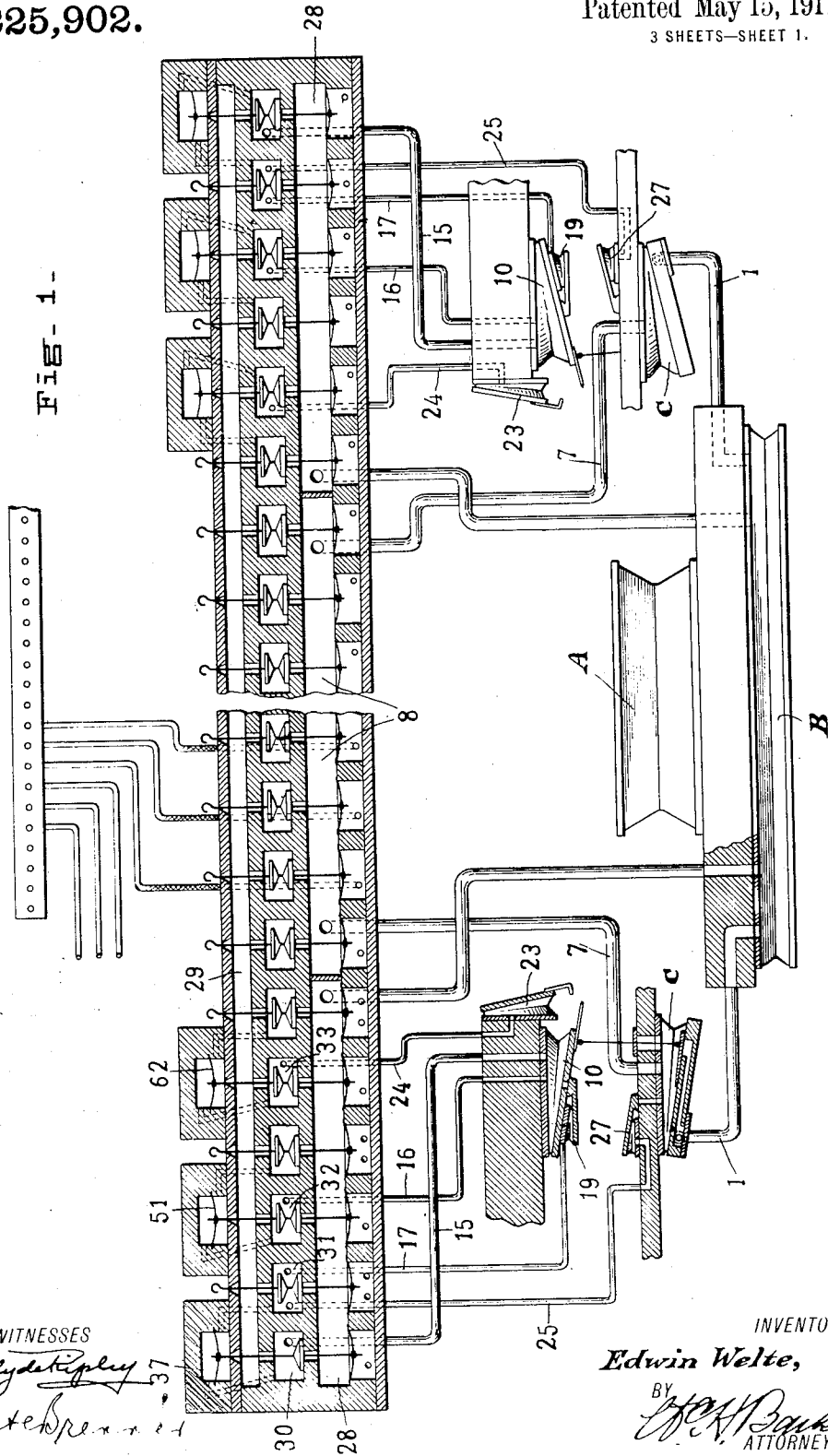
APPLICATION FILED MAY 25, 1914.

1,225,902.

Patented May 15, 1917.

3 SHEETS—SHEET 1.

FIG-1-



WITNESSES
J. J. [Signature]
Kate [Signature]

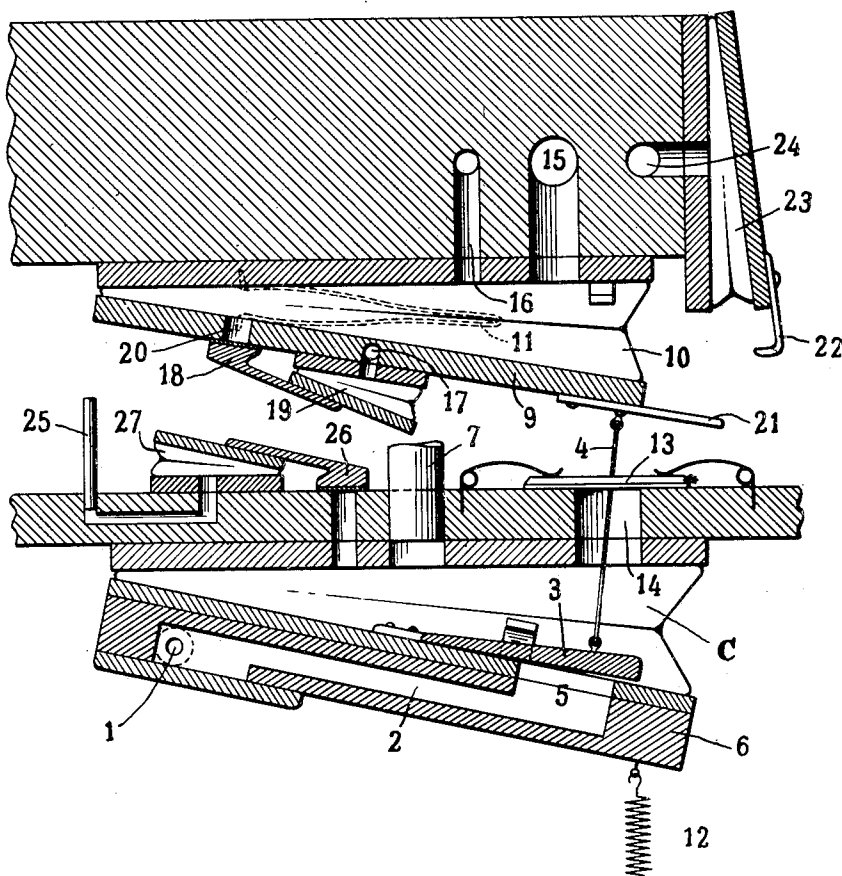
INVENTOR
Edwin Welte,
BY
[Signature]
ATTORNEY

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FIG. 2.



WITNESSES
J. G. H. H. H. H.
Kate H. H. H.

INVENTOR
Edwin Welte,
 BY *J. H. H. H.*
 ATTORNEY

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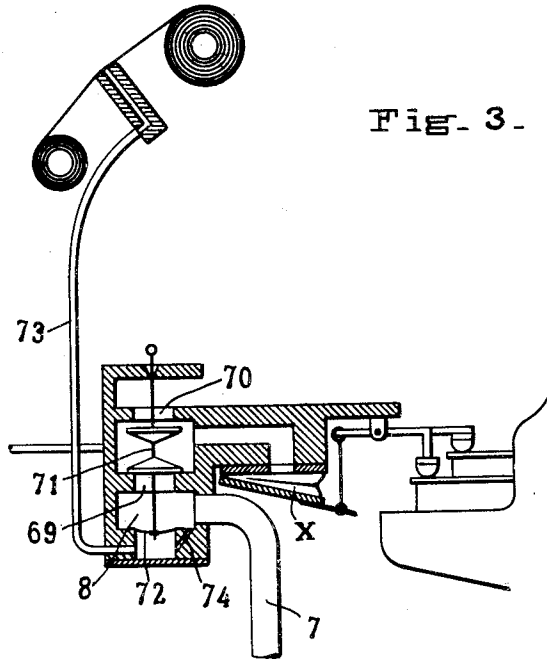


Fig. 3.

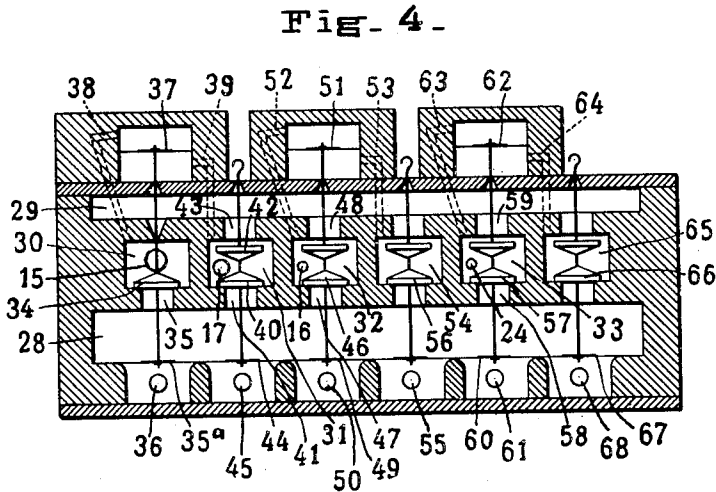


Fig. 4.

WITNESSES
J. J. ...
Kate ...

INVENTOR
 Edwin Welte,
 BY *W. A. Parker*
 ATTORNEY

UNITED STATES PATENT OFFICE.

EDWIN WELTE, OF FREIBURG, GERMANY.

PRESSURE-CONTROLLING MECHANISM FOR AUTOMATIC MUSICAL INSTRUMENTS.

1,225,902.

Specification of Letters Patent.

Patented May 15, 1917.

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To all whom it may concern:

Be it known that I, EDWIN WELTE, a subject of the Grand Duke of Baden, and a resident of Freiburg, in the Grand Duchy of Baden, German Empire, have invented certain new and useful Improvements in Pressure-Controlling Mechanism for Automatic Musical Instruments, of which the following is a full, clear, and exact description, whereby any one skilled in the art may make and use the same.

The invention relates to musical instruments of the character which are actuated pneumatically and is described herein in conjunction with pneumatic actions of the suction type although, obviously, the same principles might be applied to a pressure operated mechanism.

The invention relates more specifically to mechanism for controlling the pressure of the main source of power with reference to the striker pneumatics or pneumatic tone producing devices and embodies an arrangement whereby the most delicate expressions may be secured in the playing of an automatic instrument.

The object of the invention is to provide a mechanism in the air connections between the main source of power and player pneumatics which will provide any desired degree of pressure or suction with reference to the player pneumatics and to provide means for automatically varying the degree to any extent.

It is also an object of the invention to provide a movable wind channel having a valve seat and a movable valve which will cooperate therewith and by the relative movements of which any desired pressure may be secured and maintained within a pneumatic device.

Referring to the drawings:

Figure 1 is a diagrammatic view showing the connections of the various parts and the relative arrangement of various elements of the mechanism.

Fig. 2 is a somewhat diagrammatic view on enlarged scale with parts cut in section, illustrating the pneumatic control.

Fig. 3 is an enlarged view of a form of primary pneumatic.

Fig. 4 is an enlarged view illustrating a set of expression pneumatics.

The device, as illustrated, is shown somewhat in diagram in order to avoid confusion and no attempt has been made to illustrate

in detail the various parts of a musical instrument as such devices are well known in the art. It is to be assumed that there is a striker pneumatic representing each key or note of the instrument and that the various parts are properly inclosed and incased in any suitable form corresponding with modern practice of instrument building. As illustrated and described, a single set of operating parts is taken as an example and in the diagram of Fig. 1, a duplication is shown, representing the pressure-controlling mechanism and expression actions for a divided or sectional chest of an automatic piano player or player piano. It is, of course, to be understood that any desired arrangement of chest may be employed with reference to the entire pianoforte or other instrument and that duplications of the mechanism described herein may be used and arranged in proper form and manner to suit the exigencies of any particular requirement.

Devices for producing any required attenuation of air pressure in a musical instrument are not essentially new in the art as it is admittedly old to provide in conjunction with a main source of power or exhausting mechanism a valve controlling the communication of said exhausting mechanism with the primary or striker pneumatics, said valve having a control varied by the pressure induced in the system and also having a manual means of control by which the automatic control can be varied. Likewise, it is not essentially new to provide an automatic arrangement by which an air passage has its valve controlled by variable pressures, such as are induced and also has an automatic device for varying the operation of the automatic control. Such a device is fully described and illustrated in Patent No. 1,008,291, issued November 7th, 1911.

The present invention, while generically very similar to said patent in its general effect and operation is directed to a mechanism which obviates the dual control of a single controlling valve and provides an arrangement by which a single valve has two distinct movements, one with the main controlling or regulating device and the other with the positioning device.

As hereinafter fully described, the main valve of the system may maintain a substantially fixed relation with reference to the regulator during its entire range of move-

ment but said valve also has a variable controller which may change the position of the valve with reference to the regulator and thereby cause the regulator to respond immediately to every valve manipulation.

By the device, any and every possible modulation of expression may be secured upon the primary or striker pneumatics. They may be actuated in a manner corresponding with the lightest touch of an "artist". They may be operated with crescendo and diminuendo effects of the finest gradations or forte of mezzo-forte or piano effects may be impressed upon the striker pneumatics with the greatest exactitude, thus giving a full force and meaning which will accurately reproduce the play of any "artist".

In the accompanying drawings A represents the feeders or pumps which may be operated in any desired manner and which are connected with a chamber or bellows B adapted to maintain a substantially high and maximum suction. This chamber B communicates with a regulator C through a flexible connection 1 and a channel 2, said channel being controlled by a valve 3. The valve 3, through a suitable connection 4 normally bears a fixed relation with reference to a port 5 of the channel 2.

As illustrated in the drawings, the channel 2, port 5 and appurtenant parts are arranged in and upon the movable board 6 of the regulator C which, as illustrated, is of bellows form and has a tube or duct 7 communicating with the wind-chest 8 of the primary or striker pneumatics of the instrument.

The valve connection 4 is attached to a pneumatically controlled and movable member 9 which, as illustrated herein, is the movable board of a bellows 10. This bellows 10 is normally inflated by a spring 11 and is subject to various suction effects which cause its collapse with varying speeds and to varying degrees through its communication with the main source of power which communications are controlled by expression devices hereinafter described.

It is apparent from this much of the description that the main suction, acting through the connection 1, will cause a certain collapse of the regulator C and consequently there will be induced in the regulator and in the primary pneumatic chest 8 a certain air tension. With the pneumatically controlled device 9 or in other words, the bellows 10 in any given position, the regulator will assume a position with the valve 3 closed upon its seat at the mouth of port 5 and the regulator will maintain a tension represented by the position of its movable member with its air duct 2 and port 5 and dependent upon the pull of its inflating spring 12. Obviously, the greater the move-

ment of the movable member of the regulator C, the greater will be the back pull and the tension of the regulator C but any other suitable devices for the purpose may be employed without departing from the spirit of the invention or the scope of the subjoined claims.

To permit relative movement of the valve regulator C and the member 9, the connection 4 passes through a shutter 13, which may slide with reference to the opening 14 and give unrestricted movements to the connection 4. The pneumatically controlled device 9, 10 communicates through ducts 15, 16, 17 with pneumatically controlled devices which, as they are actuated, produce certain movements of the member 9 and thereby vary the position of the valve 3 with reference to its port 5. The duct 17 which is controlled by a pneumatic action hereinafter described, actuates a valve 18 through a bellows or pneumatic 19. The valve 18 controls a port 20 opening to the atmosphere and as the valve 18 is opened, the bellows 10 is free to expand instantly, whereby the member 9 instantly lowers the valve 3 toward the valve opening 5.

The member 9 has extending from it a stop member 21 which may be engaged by a latch 22 that is pneumatically operated through a bellows 23 which has a duct 24 communicating with a pneumatic controlling device. The latch 22 is effective for preventing collapsing movements of the bellows 10 at certain times and is also effective for holding the bellows 10 in a definite position when the latch 22 is engaged with the member 21. This stop and latch mechanism is particularly advantageous and effective in that a reduction in the perforations in the music sheet will be effective for translating certain passages. In other words, as hereinafter described, the latch member 22, through a perforation in the roll may assume a position to limit the movements of the member 9 and stop 21 and will thus maintain the valve 3 in a given position during a continued movement of the music sheet and until the music sheet again releases the latch 22.

The pneumatic devices, which communicate through the ducts 15, 16, 17 and 24 are best illustrated in Fig. 4 and, of course, the arrangement and number of these devices may be modified to suit any combination of ducts which it may be desirable to use. As illustrated in the drawings, there are six distinct pneumatic actions each controlled from the tracker-board of the instrument and in turn controlling the ducts 15, 16, 17 and 24. One of these actions also controls a duct 25 which actuates a valve 26 through the medium of a pneumatic 27. The valve 26 is designed to admit atmospheric air to the controller C in order that it may be in-

stantly inflated by its spring 12. The inflation of the pneumatic C is substantially concurrent and simultaneous with the inflation of the bellows 10 when valves 18 and 26 are simultaneously opened so that as the regulator C drops to its full position of extension, the valve 3 will immediately follow and nearly close the port 5, giving the lowest pressure in the regulator C.

The six pneumatic actions for controlling the various ducts 15, 16, 17, 24 and 25 are substantially identical in formation and as illustrated in Fig. 1, are located at either side of the main bank of player or primary pneumatics. There is a main wind chest 28 common to all of the actions and a duct 29, which is open to the atmosphere. A valve chamber 30 communicates through the duct 15 with the bellows 10 and represents the forte or high tension position for the valve 3. A valve chamber 31 connecting through the duct 17 represents a control for the "piano" or low tension position of the valve 3. A valve chamber 32 communicating through the duct 16 represents a crescendo control for the valve 3. A valve chamber 33, communicating through the duct 24, controls the pneumatic 23 and the latch 22 with reference to the stop 21. The duct 25, which controls the valve 26 is also controlled through the valve chamber 31.

The valve chamber 30 has a valve 34 controlling a port 35 leading into the wind chest 28. It has a spindle at the lower end of which is a diaphragm 35^a below which is a compartment communicating through a duct 36 with the tracker-board. At its upper end, it also has a diaphragm 37. The chamber at the upper side of the diaphragm communicates through a passage 38 with the valve chamber 30 and the chamber at the under side of the diaphragm 37 communicates through a duct 39 with the valve chamber 31.

The valve chamber 31 has a valve 40 controlling a port 41 opening into the wind chest 28 and a valve 42 controlling a port 43 which opens to the atmospheric wind channel 29. The valve spindle of the valves 40 and 42 is connected with a diaphragm 44 which overlies a chamber having a duct 45 communicating with the tracker-board.

From the above description, it is apparent that a venting of the tracker-duct 36 will raise the valve 34 and through the comparatively large duct 15, the member 10 will be rapidly collapsed, moving the member 9 and opening the valve 3. Inasmuch as the upper side of the diaphragm 37 communicates with the valve opening 30 through a duct 38, the valve 34 will remain open until pressure on the diaphragm 37 is equalized by venting the tracker-duct 45. As the tracker-duct 45 is vented, the valve 40 uncovers its port 41 and the member 10 will be immedi-

ately inflated inasmuch as the duct 17, being subjected to suction, will open the valve 18 and admit atmosphere to the member 10. This action will, of course, simultaneously subject the under side of the diaphragm 37 to suction and the valve 34 will seat upon the valve opening 35.

The valve chamber 32 likewise has a duplex valve 46 which controls an opening 47 to the wind chest 28 and a port 48 communicating with the atmospheric air channel 29. It is also provided with a diaphragm 49, the lower side of which, through a duct 50 communicates with the tracker. At its upper end, it has a diaphragm 51, the chamber at the upper side of the diaphragm communicating through a duct 52 with the valve chamber 32 while the chamber at the lower side of the diaphragm 51 communicates through a duct 53 with a valve chamber 54.

When the tracker duct 50 is vented, suction is induced through the duct 16 and the member 10 is collapsed at a relatively slow speed as compared with its collapse when the duct 15 is in operation. Suction through the duct 16 continues until the tracker duct 55 is vented and thereupon, the duplex valve 56 of the chamber 54 rises and subjects the under side of the diaphragm 51 to a suction equal to the suction at its upper side. Thereupon, the valve 46 closes the valve opening 47 and establishes communication between atmospheric air channel 29 and pneumatic 10 through port 48 and duct 16.

The valve chamber 33 is controlled by a duplex valve 57 which normally controls the port 58 leading to the wind chest 28 and which, as it rises, uncovers said port and closes the atmospheric port 59. The spindle of this valve has a diaphragm 60 at its lower end, covering a chamber which has a tracker-duct 61. At the upper end of the spindle, there is a diaphragm 62, the chamber at the upper side of which communicates through a duct 63, with the valve chamber 33 while the chamber at the lower side of the diaphragm, communicates through a duct 64 with the valve chamber 65.

As the tracker-duct 61 is vented, the valve 57 rises, subjecting the duct 24 to the action of suction, which suction is maintained and holds the pneumatic 23 in collapsed position until the valve 66 of the chamber 65 rises and subjects the under side of the diaphragm 62 to equal suction with its upper side through the duct 64.

The valve 66 is controlled by a diaphragm 67 below which is arranged a tracker-duct 68.

From the above, it is apparent that the valve 3 of the regulator C will be constantly under exact automatic control of the tracker-board. The venting of the opening corresponding to the ducts 36, 45, 50, 55, 61 and 68 will give practically innumerable move-

ments to the member 10 with any and all desired speeds so that the control of the valve 3 may be modified to any and all degrees. At the same time, the movement of the valve seat at the mouth of port 5 is controlled so that there is in effect a pneumatic compensation between the movements of the pneumatic 10 and the regulator C which give an infinite number of positions and an infinite degree of regulation for the valve 3. This regulation is effective upon the primary or striker pneumatics so the attack and dynamic effects of said pneumatics may be varied and graded to the finest perceptible degree, depending upon the pneumatic control through the tracker and appurtenant parts. The valve 3 is in effect a pneumatically controlled valve. Primarily, with the member 9 in any definite position, suction induced in the regulator C will cause a movement of the channel 2 and port 5 which will give a permanent regulation of tension in said member C irrespective of the repletion of pressure caused by operating a few or many of the primary pneumatics and through the pneumatic devices connected with the valve 3, the regulator C may be caused to assume various positions and consequently impose innumerable variable tensions upon the primary or striker pneumatics. Any tension induced in the regulating device C will be automatically maintained upon the primary or striker pneumatics, inasmuch as any depletion of tension will be immediately compensated for by a wider opening of the valve 3 due to the dropping of the movable member of the regulator and consequent opening of the port 5.

The striker pneumatics may be of any desired type and are, of course, arranged one for each of the notes or keys of the instrument and communicate with the wind chest 8 which may be divided as to the treble and base or may have any number of divisions so long as each section is in communication with a regulator C and its associated parts.

As illustrated herein, the primary pneumatics are indicated at X and each communicates with the regulated wind chest 8 through a port 69 or with the atmosphere through a port 70. The duplex valves 71 control the ports 69, 70 and said valve is in turn controlled by a diaphragm 72, the under side of which, through a duct 73 communicates with the tracker-board. The bleed-hole or duct 74 communicates with the chamber below the diaphragm 72 and with the wind chest 8 so that the valve may normally re-seat itself. The operation of this part of the mechanism is well understood. As one of the tracker-openings is vented, the diaphragm 72 rises and in turn opens the port 69, subjecting the striker pneumatic X to the tension or suction of the wind chest 8. Simultaneously, the atmos-

pheric port 70 is closed. As soon as the note is struck, the valve 71 re-seats itself upon the port 69 cutting off the communication between the primary pneumatic and chest 8 and admitting atmosphere to the primary pneumatic through port 70.

Obviously, the exact details and arrangement of the various parts of the structure described may be modified to suit the exigencies of any particular case and of course, the mechanism may be re-organized and rearranged to be used in conjunction with any type of pneumatically operated instrument. In the device, as described, however, it is apparent that any attenuation of air may be automatically secured through the regulator and pneumatic controlling devices therefor, so that the striker pneumatics may be actuated with uniformity whether high, low or any intermediate pressure is being used. This condition is effected by employing a main source of power in conjunction with striker pneumatics and with the regulator for maintaining a uniformity of pressure of the main source of power with reference to the striker pneumatics for high, low and all intermediate pressures. The regulator has a purely pneumatic control effected by a system of pneumatic devices and connections by which the regulator itself, through its valve and pneumatic connections, maintains an accurate and complete control upon the air pressures induced by the main source of power and transmitted to the primary striker pneumatics.

What I claim as my invention and desire to secure by Letters Patent is:

1. In combination; striker pneumatics, a main source of power for actuating said striker pneumatics, a regulator comprising a movable member having a port provided with a valve, for controlling communication between the main source of power and the striker pneumatics, the said valve being arranged to move bodily with said movable member, and a pneumatic device connected to said valve and arranged when actuated to impart a movement to the valve relatively to the movable member.

2. In combination, striker pneumatics, a main source of power, a regulator having a movable member provided with a port communicating with the main source of power, a valve controlling said port, said valve being arranged to move with and to have movement relatively to the movable member and pneumatically actuated devices mounted for movement with and movable independently of the movement of the regulator and connections between said devices and the valve for varying the position of the valve of said regulator whereby any pressure may automatically be maintained by the regulator.

3. A regulating device for musical instru-

ments comprising a movable regulating member having a wind passage, a main source of power communicating therewith, a valve moving with said movable regulator and controlling said wind passage, pneumatically actuated means connected with said valve and including automatic pneumatic controlling mechanism arranged to cause the said means to move with or have a movement relative to the movable regulating member.

4. In combination, a source of power, a regulator comprising a movable member having an air passage communicating with said source of power, a valve carried thereby and having a bodily movement corresponding to the movements of the regulator pneumatic devices communicating with the main source of power by which said pneumatic devices are controlled, connections between said devices and the valve of the regulator arranged to move simultaneously therewith or to have a movement relatively thereto whereby the regulator will assume different positions with reference to the controlling valve and determine the action of the main source of power with reference to the regulator.

5. In combination, striker pneumatics, a main source of power for actuating the same, a regulator communicating with said main source of power and the striker pneumatics, a valve for said regulator mounted to be controlled by the movements of the regulator, a pneumatic device communicating with said regulator through its valve and automatically controlled devices for simultaneously admitting atmospheric air to the regulator and to the pneumatic controlling device.

6. In combination, striker pneumatics, a main source of power, a regulator interposed between the main source of power and striker pneumatics, said regulator having a controlling valve movable with and having a movement independent of the regulator, a tracker-board, pneumatically operated devices intermediate the tracker-board and valve, means for varying the operation of the pneumatic devices with reference to the

valve and pneumatic connections controlled from the tracker-board for simultaneously breaking the pressure of the regulator and the pneumatic controlling devices of the valve.

7. A regulator comprising a pneumatic which includes a movable member having an air passage formed therein, connections intermediate said passage and a main source of power and connections establishing communication between the regulator and the striker pneumatics of an instrument, a valve mounted to move bodily with said movable member of the regulator and having a movement independent thereof, a pneumatic connected with said valve, automatically controlled devices for actuating said pneumatic to move said valve relatively to the regulator and pneumatically controlled devices for limiting the movement of said pneumatic valve controlling devices.

8. A regulator comprising a pneumatic which includes a movable member having an air passage formed therein, connections intermediate said passage and a main source of power and connections establishing communication between the regulator and the striker pneumatics of an instrument, a valve mounted to move bodily with said movable member of the regulator and having a movement independent thereof, a pneumatic connected with said valve, automatically controlled devices for actuating said pneumatic to move said valve relatively to the regulator, pneumatically controlled devices for limiting the movement of said pneumatic valve controlling devices, a valve for the regulator controlling an atmospheric opening, a valve for the pneumatic valve controlling devices, controlling an atmospheric opening and devices for actuating said atmospheric valves whereby a simultaneous movement of the regulator of the pneumatic actuating valve controlling devices will be secured.

EDWIN WELTE.

Witnesses:

W. M. A. TAYLOR,
W. H. BRENER.