G. P. BRAND.

VARIABLE TENSION BELLOWS.

APPLICATION FILED OCT. 7, 1905. RENEWED APR. 15, 1908.

1,009,380. **Patented Nov. 21, 1911.**

3 SHEETS—SHEET 1.

Fig. 1.

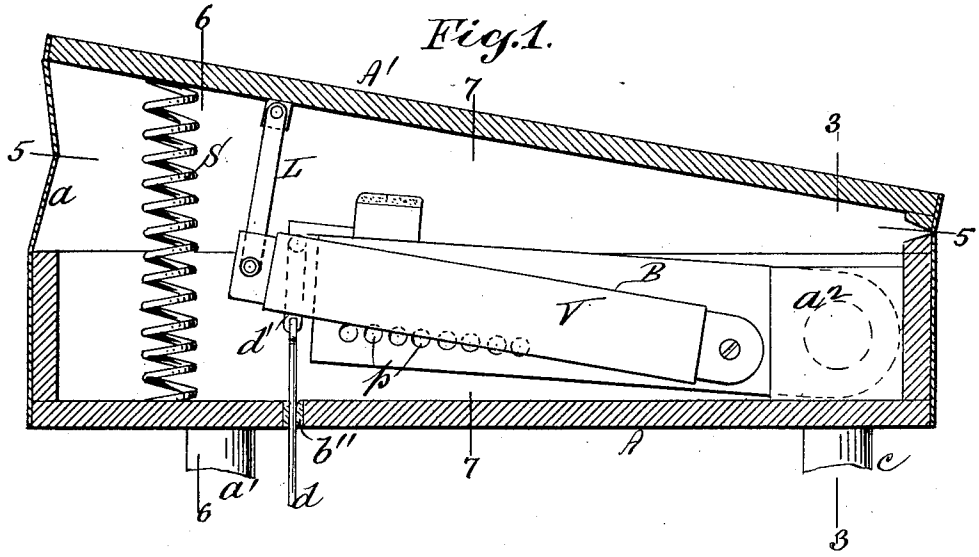


Fig. 2.

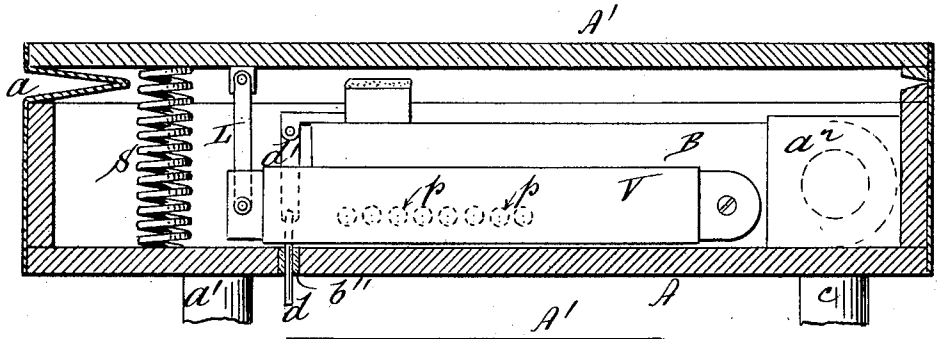
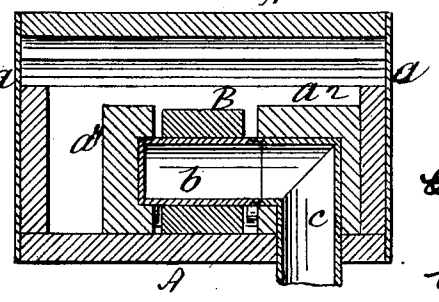


Fig. 3.



Witnesses:
D. W. Gardner.
John Murray

Inventor:
George P. Brand
By his Attorney
Geo. Wm. Mead

G. P. BRAND.

VARIABLE TENSION BELLOWS.

APPLICATION FILED OCT. 7, 1905, RENEWED APR. 15, 1908.

1,009,380. Patented Nov. 21, 1911.

3 SHEETS—SHEET 2.

Fig. 4.

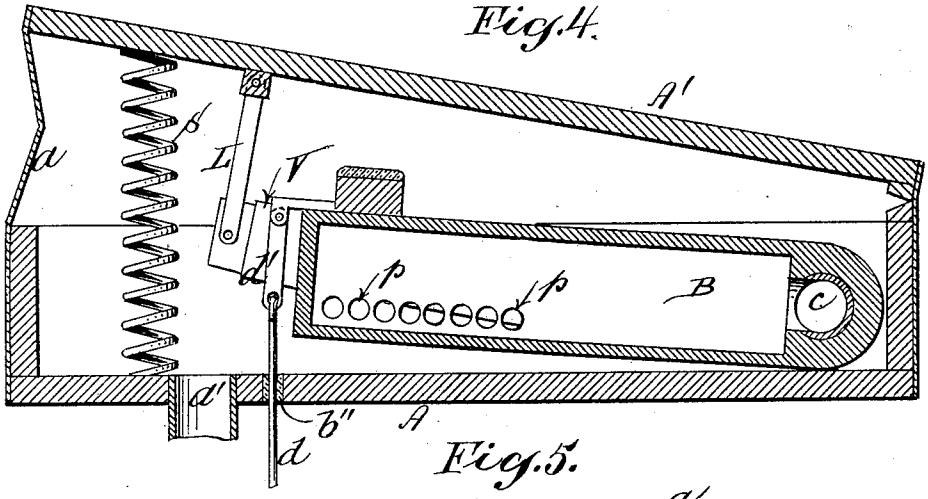


Fig. 5.

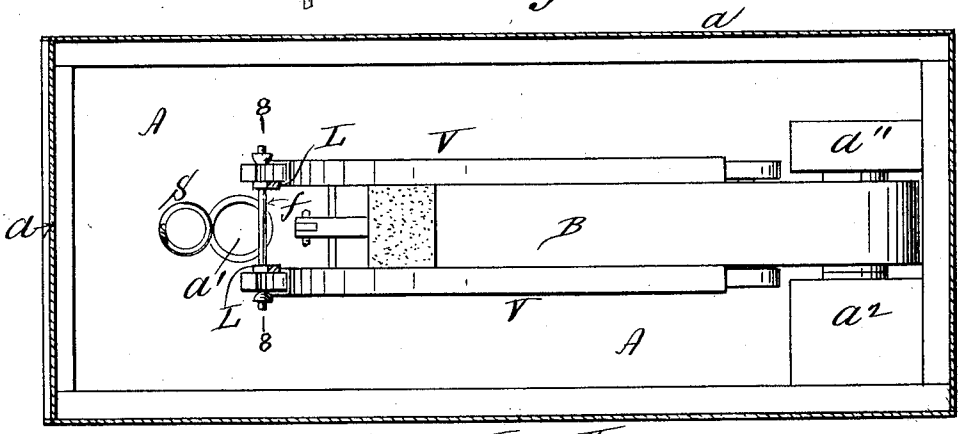


Fig. 6.

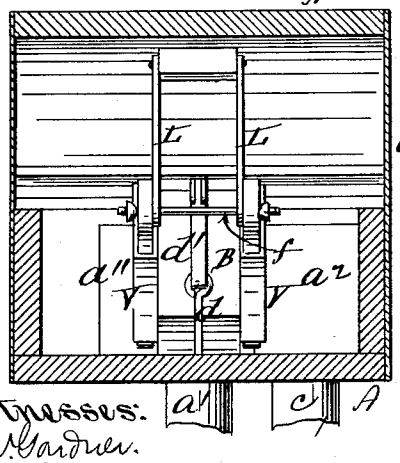


Fig. 8.

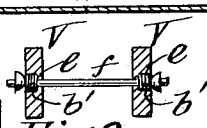
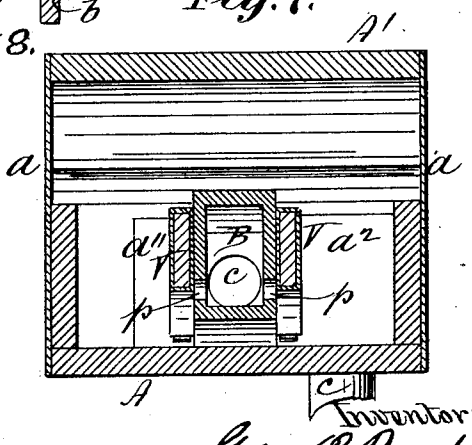


Fig. 7.



Witnesses:
D. W. Gardner.
John Murray

Inventor:
George P. Brand
By his Attorney
Geo. Wm. Miall

G. P. BRAND.

VARIABLE TENSION BELLOWS.

APPLICATION FILED OCT. 7, 1905. RENEWED APR. 15, 1908.

1,009,380. **Patented Nov. 21, 1911.**

3 SHEETS—SHEET 3.

Fig. 9.

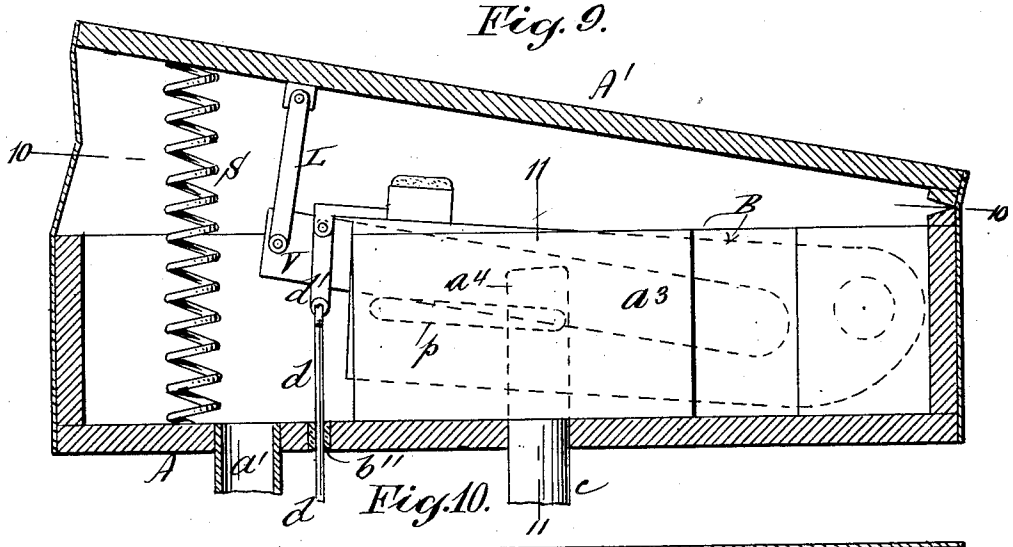


Fig. 10.

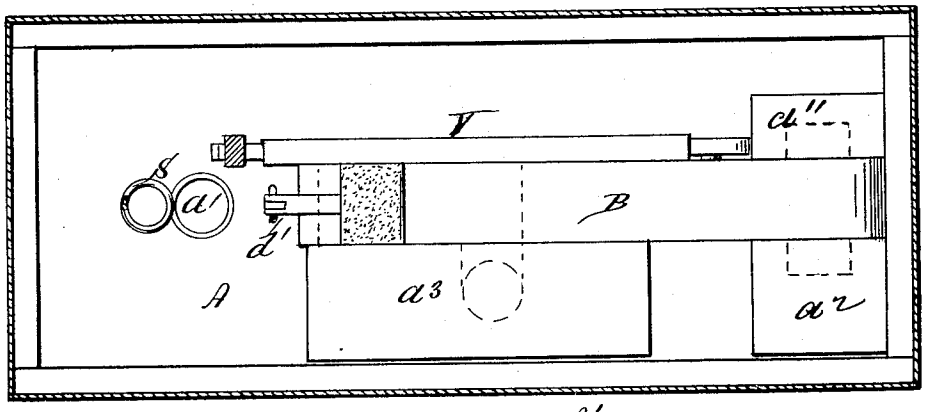
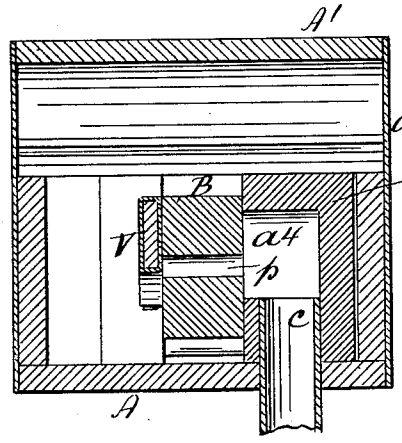


Fig. 11.



Witnesses:
D. W. Gardner.
John Murray

Inventor:
George P. Brand
By his Attorney
Geo. W. Mead

UNITED STATES PATENT OFFICE.

GEORGE P. BRAND, OF NEW YORK, N. Y.

VARIABLE-TENSION BELLOWS.

1,009,380. Specification of Letters Patent. **Patented Nov. 21, 1911.**

Application filed October 7, 1905, Serial No. 281,835. Renewed April 15, 1908. Serial No. 427,209.

To all whom it may concern:

Be it known that I, GEORGE P. BRAND, a citizen of the United States, residing in the borough of the Bronx, city, county, and State of New York, have invented certain new and useful Improvements in Variable-Tension Bellows, of which the following is a specification.

My invention relates to variable tension expression bellows for pneumatic apparatus used in automatic music playing devices, such as mechanical players and the like, as set forth in my concurrent application No. 202,543 filed April 11, 1904, on which my present construction is an improvement. In both cases the design is to afford means whereby a so called normal tension or pressure in the wind chest with which the sound actuating pneumatics are connected, may be set or regulated or varied temporarily, and whereby the degree of tension thus prescribed for the wind chest may be maintained automatically with the minimum degree of fluctuation from normal.

In my concurrent application above referred to the port block is stationary and the thrust of the pivoted valve blades is governed by an adjustable slide upon the movable member of the bellows to which they are linked, under which circumstances the scope or capacity of the bellows is necessarily restricted somewhat owing to the limitation of the extent of adjustment of the valve blades with relation to the stationary ports.

The main object of my present improvement is to obviate this difficulty and to make the variable tension expression bellows more sensitive and responsive by increasing the extent of available motion between the parts so as to afford a longer sweep and greater freedom in opening and closing the bellows,—so as to afford more elasticity and resilience, in fact, to the end that greater delicacy may be attained in varying and regulating the tension in the wind chest for the purpose of accentuating the action of the pneumatics connected therewith. This I accomplish by making the port block adjustable with relation to the valve blades so that the ports may be varied in position with relation to said blades irrespective of the position of the latter in the bellows, or in other words, irrespective of the degree to which the bellows may be expanded or contracted. Thus the ports may be made to follow up or recede from the valve blades, and a quicker responsive action insured than in the older form referred to in which the valve blades had to work down or with relation to fixed ports. For instance, the valve blades being in both the present and the concurrent case referred to, linked to the movable member of the bellows, if the latter were inflated to approximately its full extent or capacity under the old conditions referred to the bellows would have to be deflated to a very considerable extent before the valve blades could effect any material change in the area of the port openings even when the valve blades were adjusted to the full limit of their stroke, whereas by my present arrangement I am enabled to quickly regulate the position of the ports with relation to the valve blades no matter what the position of the latter may be, nor to what extent the bellows may be inflated or deflated. Hence, obviously I am enabled to attain quicker and more delicate variations of tension in the wind chest and consequently a greater scope of expression and accentuation through the medium of the sound actuating pneumatics communicating with the wind chest. I am also enabled to materially increase the capacity of the expression bellows, and the extent of motion of the movable member thereof, and thereby attain greater elasticity and resilience in action. I am also enabled to use a relatively longer spring within the bellows which fact contributes materially to the sensitiveness and delicacy of operation of the device, at the same time rendering the structure more compact than heretofore, where the spring has been situated external to the bellows. Furthermore by making the port block adjustable with relation to the valve blades instead of the reverse arrangement as heretofore, I attain greater stability of adjustment since the port block is less liable to slip or work out of position.

In the accompanying drawings, Figure 1, is a sectional elevation of my improved variable tension bellows, the parts being in what may be designated as a normal position; Fig. 2, is a sectional elevation of the same showing the relative positions of the parts when the bellows is deflated, and the port block set at a point to cause greater tension in the bellows for the same relative position of the valve blade; Fig. 3, a transverse section upon plane of line 3—3— Fig. 1; Fig. 4, is a central longitudinal section through the bellows, the parts being in the

position shown in Fig. 1; Fig. 5, is a section taken upon plane of line 5—5— Fig. 1, showing a plan of the port block, valve blades, &c.; Fig. 6, is a transverse section taken upon plane of line 6—6— Fig. 1; Fig. 7, is a transverse section taken upon plane of line 7—7— Fig. 1; Fig. 8, is a sectional detail upon plane of line 8—8— Fig. 5; Fig. 9, is a sectional elevation showing a modification in structure; Fig. 10, is a section similar to Fig. 5, taken upon plane of line 10—10— Fig. 9; Fig. 11, is a transverse section taken upon plane of line 11—11— Fig. 9.

My improved variable tension bellows consists essentially of a stationary member A and a movable member A′, the parts being united in the usual way by flexible material *a*. A long sensitive spring S is interposed between the two members A, A′, and tends constantly to separate them, even against internal tension. The interior of the bellows is put in communication through a suitable conduit or duct *a′*, and connections with a working tension wind chest controlling the note sounding pneumatics.

Pivotally attached preferably to the stationary member of the bellows A, is an adjustable port block B, communicating through a suitable conduit or duct *c*, and connections, either directly or indirectly with a tension reservoir or exhaust mechanism. The adjustable port block is preferably, though not necessarily made hollow, and communicates through a hollow trunnion *b*, upon which it is mounted or fulcrumed with the exhaust duct *c*, as will be seen by reference, more particularly to Fig. 3, the said hollow trunnion having bearings in the stationary blocks *a″*, a^2, through which latter the exhaust duct *c*, extends.

The sides of the port block B, are formed with the ports *p*, *p*; and its position in the bellows is regulated and controlled manually or otherwise, as may be found most expedient under the conditions of use, by means of a rod *d*, pivotally connected to the port block through the medium of the link *d′*, and extending through a packed guide *b″*, in the stationary member of the bellows.

Pivotally secured to opposite sides of the adjustable port block B, are the valve blades V, V, which are also pivotally connected with the movable member A′, of the bellows by means of links L, L. The sides of the valve blades V, V, opposed to the port block are faced with leather or other packing to insure a close frictional contact therewith; and this intimate contact of the opposed surfaces is further contributed to by springs *e*, *e*, in the recesses *b′*, *b′*, formed in the valve blades near their pivotal connections with the links L, L,—said springs acting against nuts on the threaded ends of a stay rod *f*, passing through both valve blades V, V, and thus tending to hold their inner opposed surfaces against the sides of the adjustable port block B, with an elastic pressure which insures a close frictional contact of the parts which is effective in preventing leakage.

In the modification illustrated in the last three figures of the drawings only a single valve blade V is used, the port block is made solid with the exception of the port *p*, extending through it, and communication is had with the exhaust duct *c*, on the side of the movable port block opposite to that upon which the single valve blade is arranged through the medium of a stationary block a^3, formed with an elongated port a^4, which constitutes the entrance to the exhaust conduit *c*, and is so proportioned as to be always in coincidence and communication (at some portion of its area) with the port *p*, in the movable port block B, as will be understood by reference to Fig. 11, by which it will be seen that the elongated port opening a^4, is only slightly less in length than the extent of motion of the adjacent portion of the adjustable port block B.

In either arrangement shown the operation of the parts is essentially the same. The object being to maintain a prescribed degree of tension within the wind or working tension chest through the medium of the conduit *a′*, and connections, it is obvious that air admitted to said wind chest through the note sounding pneumatics, be the same more or less in quantity within a given time, should be withdrawn from said wind chest immediately and automatically without increasing the working tension above that desired and prescribed by the operator. Thus the adjustable port block B, being set to represent a prescribed degree of tension in the wind chest, any excess of air admitted from the note sounding pneumatics will inflate the bellows A, A′, and thereby cause the valve blade or blades V, to increase the available area of the port or ports *p*, more or less, to allow the tension reservoir or exhaust mechanism acting through the exhaust conduit *c*, to quickly withdraw such excess of air. As the normal tension is thus restored in the wind chest the increase in tension in the bellows A, A′, causes the movable member A′, to collapse and close the port *p*, or ports, more or less, according to the difference in tension existing in the tension reservoir or exhaust mechanism as compared with that in the wind chest. Thus if the tension in the said reservoir or exhaust mechanism is greater than in the wind chest the movable portion A′, of the bellows will collapse sufficiently to cause the valve blade or blades V to close the port or ports *p*, entirely until air admitted to the wind chest as before stated again reduces the tension therein, and allows the movable portion

A', of the bellows to expand under the action of the spring S, and these operations will be repeated indefinitely and automatically during the operation of the apparatus,—the number and extent of fluctuations being dependent upon the character and requirements of the music executed. It will readily be seen that by making the port block B adjustable with relation to the valve blade or blades V, I am enabled to attain quick responsive action at any and all degrees of tension between the maximum and minimum capacity of the apparatus,—that is to say I am enabled to follow up or recede from the valve blade or blades in such manner as to locate the exhaust port or ports in close proximity to the valve blade or blades irrespective of the position of the latter within the bellows, so that there need be no lost motion or play between the parts.

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

1. In a variable tension expression bellows for pneumatic apparatus, the combination of a port block mounted adjustably upon one member of the bellows, means for connecting said adjustable port block with a tension reservoir or exhaust mechanism, a valve blade connected with the other member of the bellows, means for adjusting said port block with relation to said valve blade and means for connecting the interior of the bellows with a working tension wind chest for the purpose described.

2. In a variable tension expression bellows for pneumatic apparatus, the combination of a port block mounted adjustably upon one member of the bellows, means for connecting said adjustable port block with a tension reservoir or exhaust mechanism, a valve blade connected with the other member of the bellows, means for adjusting said port block with relation to said valve blade, a spring arranged to tend constantly to separate the members of the bellows, and means for connecting the interior of the bellows with a working tension wind chest for the purpose described.

3. In a variable tension expression bellows for pneumatic apparatus, the combination of a port block mounted adjustably upon one member of the bellows, means for connecting said adjustable port block with a tension reservoir or exhaust mechanism, a valve blade connected with the other member of the bellows, means for adjusting said port block with relation to said valve blade, a coiled spring within the bellows arranged to tend constantly to separate its members and means for connecting the interior of the bellows with a working tension wind chest for the purpose described.

4. In a variable tension expression bellows for pneumatic apparatus, the combination of a port block mounted adjustably upon one member of the bellows, means for connecting said adjustable port block with a tension reservoir or exhaust mechanism, a valve blade pivotally connected with the other member of the bellows and pivotally connected to the said adjustable port block, means for adjusting said port block with relation to said valve blade, and means for connecting the interior of the bellows with a working tension wind chest for the purpose described.

5. In a variable tension expression bellows for pneumatic apparatus, the combination of a hollow port block pivotally supported on one member of the bellows, a hollow fulcrum upon which the said port block is mounted communicating with a tension reservoir or exhaust mechanism, a valve blade connected with the other member of the bellows, means for adjusting the said port block with relation to the said valve blade, means which tend constantly to separate the members of the bellows, and means for connecting the interior of the bellows with a working tension wind chest, for the purpose described.

6. In a variable tension expression bellows for pneumatic apparatus, the combination of a hollow port block supported on one member of the bellows, a hollow fulcrum upon which the said port block is mounted communicating with a tension reservoir or exhaust mechanism, a valve blade linked to the other member of the bellows and pivotally connected to the adjustable port block, means for adjusting the said port block with relation to the said valve blade, means which tend constantly to separate the members of the bellows and means for connecting the interior of the bellows with a working tension wind chest for the purpose described.

7. In a variable tension expression bellows for pneumatic apparatus, the combination of a hollow port block formed with ports in its opposite side walls and supported on one member of the bellows, a hollow fulcrum upon which the said port block is mounted communicating with a tension reservoir or exhaust mechanism, valve blades linked to the other member of the bellows and pivotally connected to opposite sides of the said adjustable port block, means for adjusting the said port block with relation to the said valve blades, means which tend constantly to separate the members of the bellows, and means for connecting the interior of the bellows with a working tension wind chest, for the purpose described.

8. In musical apparatus, an expansible pneumatic, a valve in said pneumatic moved by the expansion and collapsing thereof, a valve seat in said pneumatic coöperating with said valve, and manually operative means extending out of said pneumatic for

moving said valve seat, for the purpose specified.

9. In a mechanically played musical key instrument, the combination of a regulating bellows, a movably mounted member having an opening, and an independently movable member controllable by said bellows and movable over the first-named member for controlling the opening therein.

10. In a mechanically played musical key instrument, the combination with an air trunk and the opening thereto, of a regulating bellows with the interior of which said opening communicates and a member movably mounted within said bellows with relation to said opening and provided with an opening, and a secondary movable member within said bellows operatively connected with the latter and mounted to move upon the first-named member to control the opening therein.

11. In musical apparatus, an expansible pneumatic comprising two chambers, air passages leading from each of said chambers, a passage between said chambers, a manually movable valve seat covering said last-named passage, and a valve coöperating with said seat and moved by the expansion and collapsing of said pneumatic, for the purpose specified.

12. In a mechanically played musical key instrument, the combination with an air trunk and the opening thereto, of a regulating bellows, and two independently movable members both upon the same side of said opening, one of said members having an opening and the other movable thereover.

13. In a mechanically played musical key instrument, the combination with the air trunk and the opening thereto, of a regulating bellows and two independently movable members slidable one upon the other, one constructed to control the flow of air through said opening, one of said members being controllable by said bellows.

14. In a mechanically played musical key instrument, the combination with an air trunk and the opening thereto, of a regulating bellows, of two independently movable members both upon the same side of the opening, one of said members controlling the flow of air through said opening, one controlled by the bellows and the other by hand.

15. In a mechanically played musical key instrument, the combination with an air trunk and the opening thereto, of a regulating bellows, an apertured member movable over said opening and manually controlled and a member movable with relation to said apertured member and controlled by said bellows.

GEORGE P. BRAND.

Witnesses:
GEO. WM. MIATT,
D. W. GARDNER.