No. 896,686. PATENTED AUG. 18, 1908.

G. P. BRAND.

VARIABLE TENSION EXPRESSION BELLOWS FOR PNEUMATIC APPARATUS.

APPLICATION FILED JUNE 29, 1907. RENEWED JULY 18, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

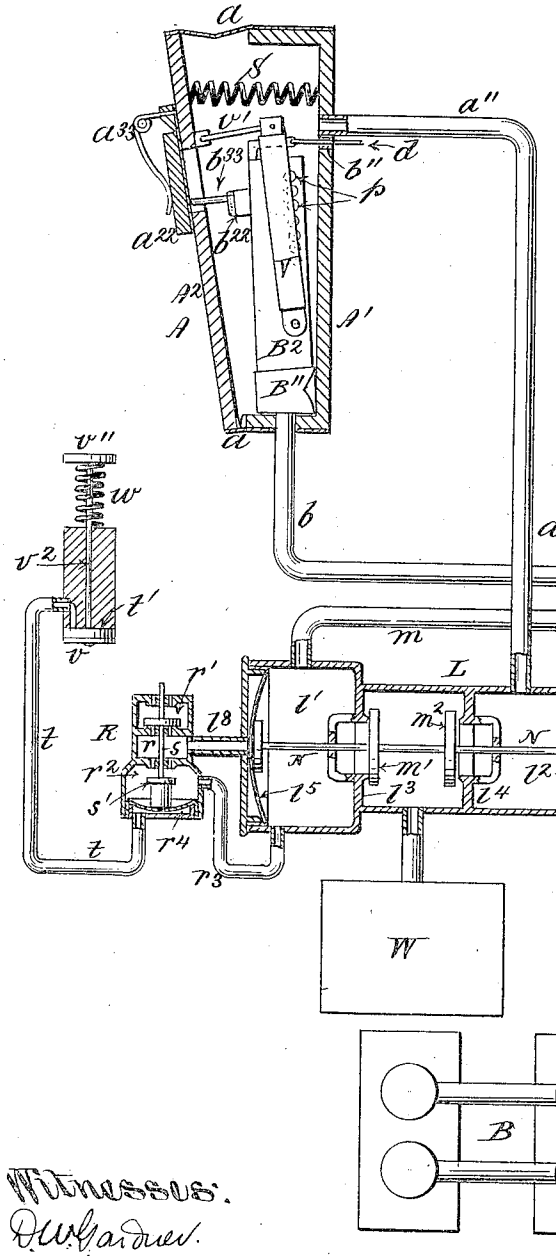


Fig. 2.

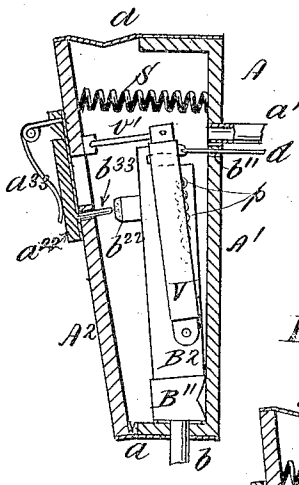
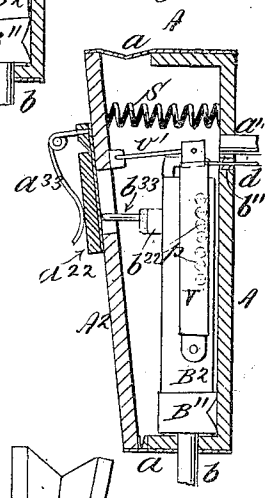


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

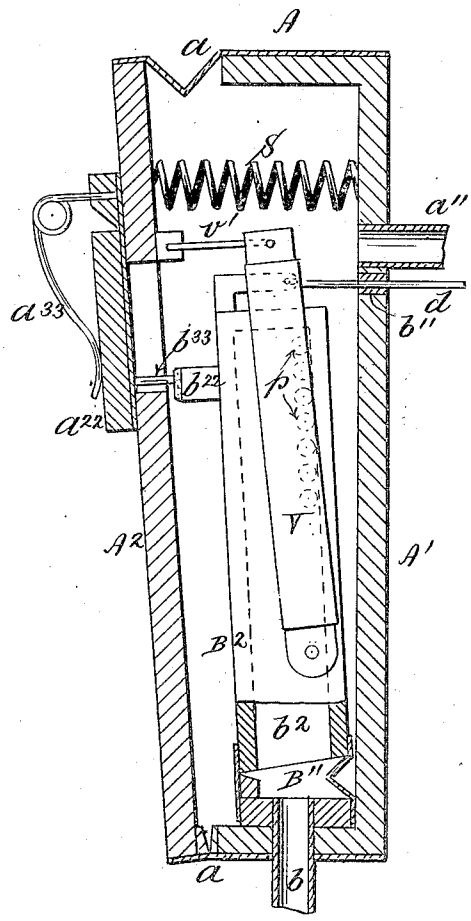
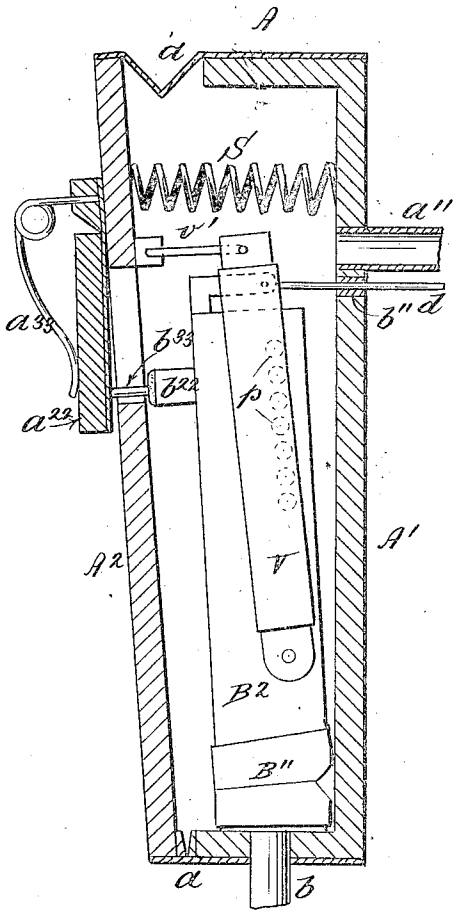


Fig. 5.



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VARIABLE-TENSION EXPRESSION-BELLOWS FOR PNEUMATIC APPARATUS.

No. 896,686. Specification of Letters Patent. Patented Aug. 18, 1908.

Application filed June 29, 1907, Serial No. 381,418. Renewed July 18, 1908. Serial No. 444,203.

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 Expression-Bellows for Pneumatic Apparatus, of which the following is a specification.

My invention relates to variable tension expression bellows for pneumatic apparatus used in automatic music playing devices, to control communication between the exhaust mechanism and the wind chest with which the sound actuating pneumatics are connected, and designated as the expression bellows.

The object of the invention is to automatically relieve the tension in the expression bellows by the admission of air thereto whenever the bellows is thrown into communication with a condition of high tension in the wind chest, or when the throttling mechanism is changed manually or otherwise from a relatively high tension to afford a lower tension,—the admission of air neutralizes or counterbalances the external pressure upon the movable member of the bellows. By this means the tendency to "kick" or collapse suddenly and forcibly when the tension is suddenly increased in the expression bellows is overcome or checked in its incipient stage, and provision is made for changing or setting the throttling mechanism to a desired decrease or normal tension without having to wait until the high tension is relieved by air from the wind chest and this result is accomplished irrespective of the position of the throttling mechanism within the bellows. That is to say the relief valve will be immediately available and operative at both extremes of adjustment of the throttle mechanism or at any intermediate position thereof, as hereinafter more fully set forth.

The invention consists essentially in providing the variable tension bellows with a relief valve which is opened by the movable member of the bellows whenever said movable member is sufficiently collapsed for the purpose or whenever the throttle mechanism is set to a lower tension, and in certain other features hereinafter described and claimed specifically.

In the accompanying drawings, Figure 1, shows diagrammatically an arrangement of parts whereby my variable tension bellows may be cut off temporarily from communication with the wind chest and the latter thrown into direct communication with the main storage or exhaust mechanism; Fig. 2, is a sectional detail of my improved bellows showing an alternative construction; Fig. 3, is a sectional view showing the port block in a different position from that shown in Figs. 1 and 2: Fig. 4, is a sectional view upon an enlarged scale showing the relative positions of the parts just prior to the opening of the relief valve; and Fig. 5, a similar view showing the relief valve open.

In illustrating the practical application of my invention I herein show and describe my improved variable tension bellows as used in conjunction with means for throwing the wind chest into direct communication with the main storage of the exhaust when unusually quick, full and powerful accentuation is required, although this arrangement forms no part of my present invention nor do I limit myself to such use of my variable tension bellows. Furthermore the latter is shown as provided with a movable port block as in my concurrent applications Nos. 281,835 filed October 7, 1905, and 296,311 filed January 16, 1906, although I do not restrict myself in this respect.

In the drawings W represents a wind chest of any desired construction with which the sound actuating pneumatics are connected,—said wind chest being also in communication, indirectly, with the variable tension bellows A, and with the exhaust mechanism B. Thus, the variable tension bellows A is shown as connected with the main storage bellows M, interposed between it and the exhaust mechanism B, and with the valve chest L, interposed between it and the wind chest W, said valve chest L, being also in communication with the main storage bellows M.

The variable tension bellows A, consists essentially of a stationary member A′, and a movable member A^2, the parts being united in the usual manner by flexible material *a*. A long sensitive spring S is interposed between the members A′, A^2, and tends constantly to separate them, even against internal tension.

Attached to the stationary member A′, of the bellows A, is a pneumatic B″, communicating through the exhaust duct b, with the main storage bellows M. Attached to this internal pneumatic B″, is an adjustable port block B^2, the interior passage b^2 being in communication with the interior of the pneumatic B″, as will be seen by reference to Fig. 4. The sides of the port block B^2, are formed with ports p, p, and its position in the variable tension bellows A is regulated and controlled manually or otherwise by means of a rod d, pivotally connected to the port block B^2, and extending through a packed guide b'', in the stationary member of the bellows. Pivotally secured to the opposed sides of the port block B^2, are valve blades V, V, which are also pivotally connected to the movable member A^2, of the bellows by means of the links v', v'. The sides of the valve blades V, V, opposed to the port block B^2, are faced with leather or other packing to insure a close frictional contact therewith. The adjustable port block B^2, being set to represent a prescribed degree of tension in the wind chest W, any air admitted to the latter through the note sounding pneumatics will inflate the bellows A, more or less and thereby cause the valve blades V, to increase the available area of the ports p, proportionately, which will allow the tension reservoir M, and exhaust mechanism B to quickly withdraw such excess of air. As the prescribed normal tension is thus restored to the wind chest W, the increase of tension in the bellows A, causes its movable member A^2, to collapse more or less and partially close the ports p, according to differences in tension existing in the tension reservoir M, or exhaust mechanism B, as compared with that in the wind chest W. Thus the tension in the main storage reservoir M, or exhaust mechanism B, being greater than in the wind chest, the movable member A^2, of the variable tension bellows A, will move towards the stationary member A′, sufficiently to cause the valve blades V, V, to close the ports p, until air admitted to the wind chest as before stated again reduces the degree of tension therein and allows the movable member A^2, of the bellows A to move away from the stationary member A′, under the action of the spring S, and these pulsations will be repeated continually and automatically during the operation of the apparatus,—the number and extent of the fluctuations being dependent upon the requirements of the music executed.

Provision is thus made for ordinary accentuation by means of the pneumatic A, and also for extraordinary or very powerful accentuation when desired by means which admit of the wind chest W being thrown temporarily into direct communication with the main storage reservoir M. This I accomplish by connecting the wind chest W, with the middle chamber l, of the valve chest L, having end chambers l', and l^2, connected respectively by means of the duct m, with the main storage reservoir M, and by means of a duct a'', with the variable tension bellows A. The partitions l^3 and l^4, which divide the chest L, into the three compartments l, l', l^2, are each formed with ports and valve seats opening into the central compartment l. These ports are closed alternately by valves m' and m^2, upon a rod N, the opposite ends of which abut against diaphragms l^5, l^6. The space back of the diaphragm l^6, communicates with the atmosphere through a hole l^7, in the end of the chest L, and the space back of the other diaphragm l^5, communicates through a duct l^8, with a middle chamber r in a secondary valve chest R, which is formed with an air chamber r', connecting with the atmosphere and with a tension chamber r^2, communicating through the duct r^3, with the tension chamber l', in the valve chest L. In the lower part of the chamber r^2, is a diaphragm r^4, upon which rests the lower end of a valve stem s, said stem carrying two valves s', and s^2, arranged respectively to engage alternately with seats in the partition which separates the middle chamber r from the other. The space under the diaphragm r^4, communicates through the duct t with a valve seat t', upon which the valve v is held normally by the spring w, interposed between a stationary part and the finger button on the other end of the valve stem v^2. In Fig. 1, the parts are shown as in their normal position in relation to each other, in which condition the wind chest W is in communication with the variable tension bellows A.

When accentuation is desired by direct communication with the main tension reservoir M, the variable tension bellows A, is cut off and the wind chest W, thrown into direct communication with said main storage bellows M. This is done by depressing the button v'', which admits air under the diaphragm r^4, thereby raising the spindle s, and admitting air to the diaphragm l^5, in the chest L, resulting in the opening of the valve m', and the closing of the valve m^2, which latter shuts off communication between the chest L and the interior of the bellows, at the same time putting the wind chest W in communication with the tension reservoir M through the medium of the chamber l', and conduit m. As a result of this cutting off of the air from the wind chest and the consequent increase of tension within the bellows, the movable member A^2, will cause the blades V to close the ports p, in the port block B, without however disturbing the adjustment of the latter. When communication is reëstablished between the variable tension chamber A and the wind chest W, by the release

and closing of the valve v, and the consequent return of the parts to the relative positions shown in Fig. 1, the high tension in the wind chest W, temporarily remaining therein as a result of its recent direct communication with the high tension reservoir M, causes the movable member A^2, of the bellows to suddenly collapse still further,—the inner side of said movable member A^2, coming in violent contact with the buffer b^{22}, on the port block B^2, under ordinary conditions as heretofore existing thereby forcing the rod d, back and disturbing the relative adjustment of the parts to which they have been set to afford a prescribed normal tension when the air from the wind chest W is passing through the bellows A, as hereinbefore mentioned.

The distinguishing feature of my present invention consists in obviating this "kick" or disturbance of parts created by the sudden increase of tension within, the bellows A when communication is reëstablished with the wind chest, by means of a relief valve a^{22}, mounted upon the movable member A^2, and actuated automatically by an internal valve opener b^{33}, when the movable member A^2, is sufficiently collapsed. The opener b^{33}, also acts to open the relief valve when the throttle mechanism is set to a lower tension, as when the movable port block is moved outward toward the movable member A^2. The degree of projection of the valve opener b^{33}, is such that the valve will in either case be opened just prior to the contact of the movable member A^2, with the buffer b^{22}, so as to admit air to the interior of the bellows A, before actual contact and thereby prevent the jar and concussion that would otherwise result. The valve opener b^{33}, is shown as projecting from the buffer b^{22}, although this is not essential provided said buffer b^{33}, is properly placed and timed with relation to the relief valve a^{22}. An external spring a^{33}, may be used in connection with the relief valve a^{22}, to hold it in its normal position if desired although this is not absolutely essential since the tension within the bellows will ordinarily hold it closed under normal conditions of use. The air thus admitted through the relief valve to counterbalance the external weight of the atmosphere on the movable member A^2, enables the spring S to react against the movable member pushing it away from the valve opener b^{33}, and allowing the latter to close, so that the prescribed normal tension will be restored, since the adjusting rod d, has remained undisturbed by the collapse of the movable member A^2. Thus the relief valve is an important factor in the practical operation of a variable tension bellows of the character designated, since it obviates all jar or disturbance of the parts and renders the resetting of a prescribed normal tension unnecessary; or if a change of setting to afford a lower tension is desired, it enables such change to be made without waiting for the air from the wind chest to effect the necessary inflation of the bellows since the admission of the necessary external air immediately relieves the tension and allows the movable member to adapt itself to the change. In this connection it is to be noted that the relief valve is always available and ready no matter what the adjustment of the port block may be since the movable member A^2, and blades V adapt themselves automatically in position with relation to the port block B.

By mounting the adjustable port block B^2, upon the pneumatic B'', as herein shown and described, in lieu of on the hollow trunnion as in my concurrent application hereinbefore recited, I reduce frictional contact and obviate all danger of corrosion of parts, since the use of metal for this purpose is thereby avoided.

It is to be noted that there is practically little or no loss of energy involved in the use of my relief valve, since only enough air is admitted thereby to the bellows to restore the normal tension to which the parts are set.

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

1. In a variable tension bellows of the character designated, the combination with the throttle mechanism, of a relief valve actuated thereby, for the purpose described.

2. In a variable tension bellows of the character designated, the combination with the port block and port-controller, of a relief valve and means upon the port block for operating said relief valve, for the purpose described.

3. In a variable tension bellows of the character designated, the combination of an adjustable port block, a port controller, a relief valve on the movable member of the bellows, and means upon said adjustable port block for opening said relief valve, for the purpose described.

4. In variable tension bellows of the character designated, the combination with adjustable internal throttling mechanism of a relief valve on the bellows and means controlled by said throttling mechanism whereby said relief valve is rendered operative thereby in the various positions to which the throttling mechanism may be adjusted, for the purpose described.

5. In variable tension bellows of the character designated, the combination of internal throttling mechanism interposed between high tension and low tension, means for adjusting said throttling mechanism, a relief valve, and means upon said throttling mechanism for operating said relief valve, for the purpose described.

6. In a variable tension bellows of the character designated, the combination of internal throttling mechanism interposed between the high tension and the low tension,

means for adjusting said throttling mechanism, a relief valve and means upon said throttling mechanism for operating said relief valve during the change from a high to a lower tension, for the purpose set forth.

7. In a variable tension bellows of the character designated, the combination of internal throttling mechanism interposed between the high tension and the low tension, means for adjusting said throttling mechanism for operating said relief valve during the collapse of the movable member of the bellows for the purpose described.

8. In a variable tension expression bellows of the character designated, 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 relief valve on one member of the bellows,—means for actuating the same through the medium of the throttling mechanism, and means for connecting the interior of the bellows with a working tension wind chest, for the purpose described.

9. In a variable tension expression bellows of the character designated, 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 the said valve blade, a relief valve in one member of the bellows, means for opening said relief valve during the collapse of the bellows, a spring arranged to tend constantly to separate the members of the bellows, and means for connecting the interior of the bellows with the working tension of a wind chest for the purpose described.

10. In a variable tension expression bellows of the character designated, the combination of a port block mounted adjustably upon the stationary member of the bellows, means for connecting said port block with a tension reservoir or exhaust mechanism, a valve blade pivotally connected with the movable 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, a relief valve mounted upon said movable member, means for opening the said relief valve during the collapse of the movable member, and means for connecting the interior of the bellows with a working tension wind chest, for the purpose described.

11. In a variable tension expression bellows of the character designated, the combination of a port block mounted adjustably upon the stationary member of the bellows, means for connecting said port block with a tension reservoir or exhaust mechanism, a valve blade pivotally connected to the said adjustable port block and with the movable member of the bellows, means for adjusting said port block with relation to said valve blade, a relief valve mounted upon said movable member, means upon the said port block for opening the said relief valve, and means for connecting the interior of the bellows with a working tension wind chest, for the purpose described.

12. In a variable tension expression bellows of the character designated, the combination of a port block mounted adjustably upon the movable member of a pneumatic in said bellows, said pneumatic communicating with a tension reservoir or exhaust mechanism, a valve blade connected with one 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 wind tension chest, for the purpose described.

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