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PNEUMATIC VALVE CONTROLLING MECHANISM FOR
MUSICAL INSTRUMENTS AND THE LIKE
Filed May 29, 1925

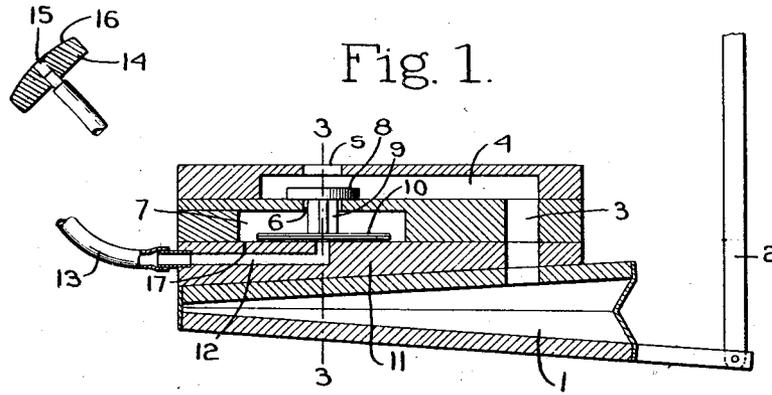


Fig. 1.

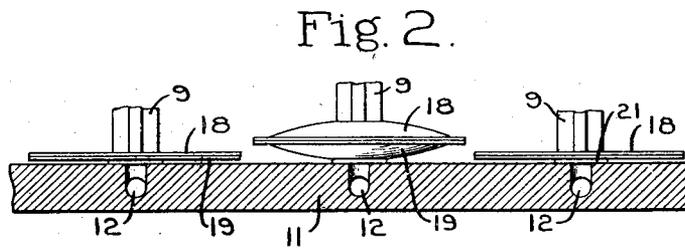


Fig. 2.

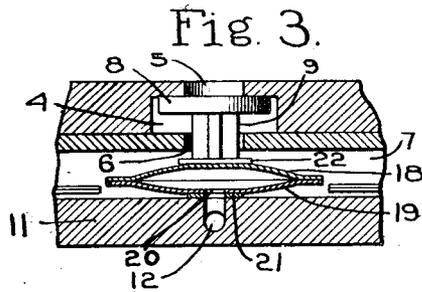


Fig. 3.

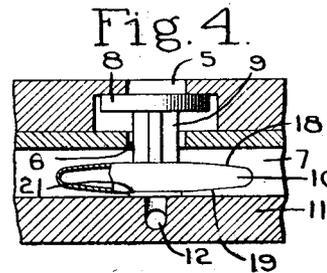


Fig. 4.

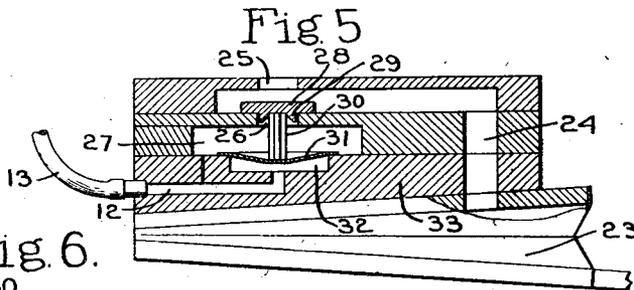


Fig. 5.

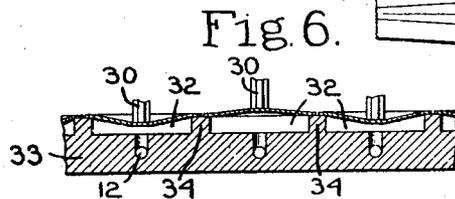


Fig. 6.

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PNEUMATIC-VALVE-CONTROLLING MECHANISM FOR MUSICAL INSTRUMENTS AND THE LIKE.

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This invention relates to improvements in pneumatic valve controlling mechanisms for musical instruments and the like and the principal object thereof is to provide a simplified, more durable and more sensitive mechanism for controlling the pneumatic which actuates the music-producing mechanism.

More specifically the invention relates to a novel valve-actuating pouch for use in pneumatic controlling mechanisms for musical instruments and the like.

In usual types of pneumatically operated controlling devices for musical instruments, such as piano players and organ players and various other devices, pneumatics, usually in the form of bellows, are employed to actuate the "pickers" which in turn actuate the music-producing mechanism. The actuation of the pneumatics or bellows is produced by changing the air pressure within the pneumatics and this is controlled by a valve or valves which act alternately to admit air to the bellows or to subject the bellows to the action of a partial vacuum. These valves are ordinarily arranged in valve chambers, one of the walls of which is in the form of a so-called pouch board having a series of countersinks over which a diaphragm of flexible material, usually sheepskin, is loosely stretched. The valve stem rests either directly or indirectly upon this diaphragm and the valve is actuated by the admission of air to the countersink beneath the diaphragm through suitable ducts which are connected by flexible tubes with ports in a tracker-bar over which a tightly drawn perforated sheet is moved.

Various defects have been found in the valve-actuating mechanism of this type. The countersinks in usual pouch boards are arranged in rows or in staggered relation and are in close proximity to each other, the distance between the adjacent edges of these countersinks being approximately three-sixteenths of an inch at the nearest point. The natural porosity of the wood frequently permits leakage from one countersink to another as the chambers of these countersinks are usually subjected to partial vacuum. This, of course, interferes with the proper operation of the controlling means. The peripheries of the diaphragms are either secured to the flat face of the tracker-bar or in very narrow countersinks

about the edges thereof and in either instance are likely to become detached in one or more places by reason of absorption of moisture and by virtue of the shrinking and expansion of the wood of the pouch board. The diaphragms themselves, which are usually made of sheepskin, are subject to expansion and contraction with variations in moisture of the atmosphere and when applied most carefully are likely to contract or expand greater in one direction than another. Consequently their action upon the valve stems is uneven and in many instances are at an angle to the axis, thus necessitating a flexible joint between the valve stem and valve in order to insure proper seating of the valve.

The manufacture of pouch boards requires expensive machinery and accurate workmanship and the securing of the diaphragms to the pouch board necessitates highly skilled labor.

One of the objects of the present invention is to provide a valve-actuating pouch which will avoid all of these objections. This is accomplished by providing a valve-actuating pouch which is self-containing and which when deflated is substantially flat and which when inflated will always act in direct alignment with the axis of the valve, which can be readily manufactured and which can be easily assembled upon the pouch board without specially skilled labor. By reason of the present invention the valve-actuating pouches can be applied directly to a pouch board presenting a flat face thus avoiding the necessity of countersinking and also enabling the use of thinner pouch boards than heretofore constructed because of the elimination of the thickness required for the countersinks and for the ducts leading to such countersinks.

A further object of the invention is to provide a valve-actuating pouch which will have a greater range of movement than the diaphragms of usual pouch boards, thus increasing the sensitiveness and activity of the pneumatic controlling mechanism.

A further object of the invention is to provide a valve-actuating pouch which will act with absolute uniformity and which will not be subject to variations by reason of change in atmospheric conditions.

A further and important object of the invention is to provide a valve-actuating

pouch which will not become loosened or displaced and this is accomplished by providing a pouch of the character above referred to in which the opposite walls of the pouch exert equal and opposite pressures upon the valve stem and a suitable abutment, such as the pouch board itself.

Other objects and features of the invention will more fully appear from the following description and the accompanying drawing and will be particularly pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawing as applied to the valve controlling mechanism for musical instruments, such as piano players or organ players, but it will be understood that the invention may be incorporated in other controlling mechanisms to which it is applicable within the scope of the claims.

In the drawing:

Fig. 1 is a vertical sectional view through the pneumatic controlling mechanism of a piano player or organ player showing the conduit which leads to the tracker-bar broken away;

Fig. 2 is a vertical sectional view through a novel form of pouch board with the valve-actuating pouches mounted thereupon, two of such pouches being illustrated in deflated and one in inflated positions;

Fig. 3 is an enlarged detail view, mainly in vertical section, on line 3—3 Fig. 1, showing a valve pouch formed of two sheets of material united at their peripheral edges;

Fig. 4 is a similar view showing a valve pouch the walls of which are integral;

Fig. 5 is a vertical sectional view similar to Fig. 1, of a usual type of pneumatic controlling device; and,

Fig. 6 is a vertical sectional view of the usual forms of pouch board and illustrating the manner in which the pouches are secured thereto.

The pneumatic controlling mechanism for musical instruments illustrated in Figs. 1 to 4 inclusive comprises a pneumatic or bellows 1 which is connected by a suitable link 2 to the picker mechanism which actuates the playing mechanism of a piano or organ. The action of the pneumatic or bellows 1 is produced by the exhaustion and admission of air to the pneumatic or bellows through a conduit 3 which leads from the chamber of the pneumatic to a horizontal conduit 4 which has in its upper wall a port 5 leading to the atmosphere and in its lower wall a port 6 leading to an exhaust chamber 7 which is maintained in a state of partial vacuum by the usual mechanism (not shown). The ports 5 and 6 in the construction illustrated are controlled by a disk valve 8 which has a stem 9, preferably cruciform in cross section, rigidly secured to it.

The opposite end of the valve stem may engage directly or indirectly a wall of the valve pouch 10. The opposite wall of the valve pouch 10 rests upon and desirably is fixedly secured to the pouch board 11 and is provided with a central port which communicates with a duct 12 which communicates with a flexible conduit 13 leading to the tracker-bar 14 and communicating with a port 15 therein. The perforated music sheet is stretched across the face 16 of the tracker-bar and the body of the sheet normally seals the port 15. When, however, the perforations in the music sheet register with the port 15 air is admitted and passes through the conduit 13, thence through the duct 12 in the pouch board, and through the port of the valve pouch into the valve pouch. As the valve pouch is located in the exhaust chamber the admission of air into the valve pouch serves to inflate the same, thereby raising the valve stem and valve, opening the port 6 and closing the opposite port 5 of the conduit 4 which leads to the pneumatic.

The exhaust chamber is thereby connected directly through the port 6 and conduits 4 and 3 with the pneumatic and the pneumatic quickly caused to collapse by reason of the exhaustion of air from its chamber and the atmospheric pressure upon the outer wall of the pneumatic. This causes the link 2 to actuate the picker mechanism which controls the production of the music either by the striking of a note or by the actuation of the mechanism which controls the character or quality of the sound produced. When the perforations of the music sheet pass beyond the port 15 the entrance of air into the conduit 13 is prevented and the valve is permitted to deflate. This deflation is permitted and accelerated by a bleeder port 17 which leads from the exhaust chamber to the duct 13, the air in the duct being drawn through the port 17 thereby producing a partial vacuum in the duct and the conduit 13 which leads to the tracker-bar.

The duct 17 desirably is of small diameter sufficient, however, to permit a rapid, but not too abrupt a deflation of the valve pouch. The partial exhaustion of the air from the duct 12 and conduit 13 also produces a suction action through the port 15 which aids in retaining the music sheet in contact with the tracker-bar.

The present invention comprises a novel form of inflatable valve-actuating pouch having oppositely disposed flexible wall sections with a freely movable periphery, the wall sections upon inflation of the pouch being adapted to exert oppositely directed forces upon the valve and the abutment and also comprises various simplifications of the pneumatic controlling apparatus which may be made by reason of the employment of this

novel valve-actuating pouch. Numerous advantages are also attained by the use of the novel valve pouch forming part of the invention as will hereinafter more fully appear.

The valve-actuating pouch of the present invention comprises oppositely disposed walls 18 and 19 sections of which, preferably the central sections, act respectively upon the valve stem 9 and upon a suitable abutment, such as the pouch board 11. The walls of the pouch desirably comprise two sheets of suitable flexible material which preferably are of circular form and are united at their edges or periphery. However, the valve pouch may be made of a single sheet of flexible material constructed or formed in any suitable manner. The valve-actuating pouch desirably is made of finely woven fabric imperviously coated or impregnated with rubber or a rubber composition and the peripheral edge portions of the sheets desirably are vulcanized together. Other suitable materials, however, may be used, such as rubber, zephyr skin, gut, or any other suitable flexible and impervious material.

A valve-actuating pouch comprising two sheets of material as above described is illustrated in Fig. 2, while a valve-actuating pouch formed in a single integral piece is illustrated in Fig. 4 partially in section. The valve pouch thus constructed, whether formed in juxtaposed sheets or integrally, when deflated is substantially flat as illustrated in Figs. 1 and 2, and when inflated is of oblate form substantially as illustrated in the central portion of Fig. 2.

In the use of the valve pouch the lower wall 19, which is provided with a central port 20, may be arranged to rest upon or may be connected directly to the tracker-bar 11 so that the port 20 will communicate with the duct 12 in the pouch board which leads to the conduit communicating with the tracker-bar. Desirably, however, a base 21 of relatively rigid material and preferably of narrow annular form is secured to the wall 19 of the valve-actuating pouch and surrounds the port 20. This base desirably is glued or cemented firmly to the pouch board. The opposite wall 18 of the pouch may engage the end of the valve stem 9, but desirably a plate 22 preferably of relatively rigid material, such as fibre board, is interposed between the wall 18 of the valve pouch and the end of the valve stem. This plate may be secured either to the valve pouch or the valve stem, but preferably is secured to the wall 18 of the valve pouch.

In order more fully to disclose the differences in construction between the usual pneumatic controlling mechanisms for valves and the novel mechanism forming the subject matter of the invention a usual form of

pneumatic controlling mechanism for musical instruments is illustrated in Figs. 5 and 6. In the construction illustrated in these figures the pneumatic 23, the conduit 24 with the port 25 establishing communication with the atmosphere, and the port 26 communicating with the exhaust chamber 27, may be and are the same as those illustrated in Fig. 1. The valve 28, which controls the valve ports 25 and 26, however, has a downwardly extending boss 29 which projects into the port 26 and is recessed to provide a pivotal connection with the upper end of the valve stem 30, the lower end of which rests upon a diaphragm 31 which is secured at its edges around the periphery of a countersink 32 in the upper face of the pouch board 33. The recesses 32 of the pouch board in usual constructions are of cylindrical form and the walls 34 intermediate of adjacent recesses are frequently no more than from three-thirty-seconds to one-fourth inch in thickness.

The grain of the wood oftentimes is of such porosity as to permit more or less leakage of air from one countersink to the next when the adjacent countersinks are subjected to different degrees of air pressure or vacuum. This, of course, results in improper actuation of the valves. In order to overcome this porosity the face of the valve pouch board is filled with shellac or other suitable material which is expensive both in time and workmanship and does not always fully obviate the leakage. The production of the countersinks in the face of the pouch board requires the use of expensive and inaccurate machinery and skilled labor. These objections are avoided in the present invention as the pouch board does not have to be countersunk or specially treated.

The diaphragms 31 in usual constructions are ordinarily of sheepskin and, of course, vary in thickness in accordance with the portion of the hide from which they are cut. When these diaphragms are assembled upon the pouch boards they are pressed down in their centers and then cemented around the edges. Careful work of a skilled workman is required promptly to secure the diaphragms in their places and the diaphragms, by reason of their uneven thickness and inaccuracy of application, will not bend with uniformity when air is introduced beneath them so that their action upon the valve stem is not directly in the line of the axis of the valve stem, thus requiring the flexible connection of the valve stem to the valve above mentioned. Furthermore, the inaccurate action of these diaphragms is greatly increased by reason of the fact that they stretch unevenly because they expand and contract unsymmetrically with respect to the center by reason of varying atmospheric

conditions, such as variations in humidity, and their action is also modified by the expansion and contraction of the wood due to shrinkage and warping caused by atmospheric and other conditions.

All of these objections are avoided in the present invention as the flexible walls of the diaphragm can be made with absolute uniformity and by reason of the fact that one of said walls rests upon or is secured to the base centrally and has free peripheral edges and since the opposite wall engages in its center the valve stem the forces applied are always directly in alignment with the axis of the valve stem. No flexible connection between the valve stem and valve is, therefore, required.

In usual constructions such as that illustrated in Fig. 5 the pouch board must be of sufficient thickness to provide a countersink of sufficient depth to permit the maximum movement of the valve stem required promptly to operate the valve. In the construction embodying the present invention the countersinks are unnecessary, thus permitting the use of a thinner pouch board and entirely obviating the necessity of employing special machinery for producing the countersinks. The valve-actuating pouches made in accordance with the present invention have a greater range of movement and much greater sensitiveness, this being permitted by the free movement of the edges of the valve pouch and because of the provision of two flexible walls instead of one.

By reason of the present invention the valve pouch can be made of materials which are unaffected by the action of the atmosphere and absolute accuracy of operation is thereby insured. The valve pouches of the present invention can be more easily installed and more readily replaced when necessary than valve pouches of the old construction and improper operation and required replacement is relatively rare. Inasmuch as the valve pouch is the heart of the action of the pneumatic controlling mechanism the greater sensitiveness and activity afforded by the present invention is very advantageous.

The present invention also permits the employment of disks of felt or fibre between the end of the valve stem and the wall of the valve pouch and thereby increases the life of the pouch. The material of which the valve pouch is constructed may be of much more durable substance than has heretofore been employed and the life of the pneumatic action consequently increased. The present invention permits the construction of pneumatic controlling mechanism which will occupy much smaller space than heretofore which in many instances is of great advantage in the construction and in the range of the instrument.

These and various other advantages of the present invention will be apparent to those skilled in the art. The invention permits not only a large saving in expense of construction as heretofore pointed out, but also permits a large saving in cost of materials as the cost of such materials as fine fabric coated or impregnated with rubber or rubber composition is greatly less than the cost of leather, such as sheep skins which must be of such very high quality that only one-half of the soft skin of a hide can be employed and the overhead required to carry a suitable amount of material thereby reduced.

It will be understood that the embodiment of the invention disclosed herein is of an illustrative character and that various changes in form, material, and construction of parts may be made within the spirit and scope of the claims. It will also be obvious that the invention may be applied to other uses than those specifically mentioned herein within the meaning and scope of the following claims.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. An inflatable valve-actuating pouch comprising two juxtaposed substantially flat sheets of flexible rubberized material, peripherally united, a base of relatively small area secured to the central portion of one of said sheets permitting flexure of substantially the full areas of said sheets and a port in said base and sheet for admitting air into said pouch.
2. An inflatable valve-actuating pouch comprising two juxtaposed substantially flat sheets of rubberized fine fabric vulcanized together adjacent their periphery and means for admitting air to said pouch.
3. An inflatable valve-actuating pouch comprising two juxtaposed substantially flat sheets of rubberized fine fabric vulcanized together adjacent their periphery, a base of much smaller area than said sheets secured to the central portion of one of said sheets permitting flexure of substantially the full areas of said sheets and a port in said base and sheet for admitting air to said pouch.
4. A pneumatic controlling mechanism for musical instruments comprising a pneumatic, a valve chamber communicating therewith, a pouch board forming the wall of said valve chamber and having a duct, a valve controlling the flow of air into and out of said pneumatic, an inflatable valve-actuating pouch comprising two juxtaposed substantially flat sheets of rubberized fine fabric vulcanized together adjacent their periphery, one of said sheets having a central port communicating with said duct and means for controlling the admission of air to said duct and means securing said sheet to said pouch

board around said port and only in close proximity thereto.

5 5. A pneumatic controlling mechanism for musical instruments comprising a pneumatic, a valve chamber communicating therewith, a pouch board forming the wall of said valve chamber and having a duct, a valve controlling the flow of air into and out of said pneumatic, an inflatable valve-actuating pouch comprising two juxtaposed substantially flat sheets of rubberized fine fabric vulcanized together adjacent their periphery, a circular base of small area secured to the central portion of one of said sheets and to said pouch board whereby the attached sheet will be freely flexible throughout substantially its entire area, said sheet and base having aligned central ports communicating with said duct and means for controlling the admission of air to said duct.

10 20 25 6. A pneumatic controlling mechanism for musical instruments comprising a pneumatic, a valve-chamber and pouch board therebeneath presenting a flat surface forming the lower wall of said valve-chamber and

having a duct therein leading to said valve-chamber, a conduit communicating with said pneumatic having aligned ports communicating respectively with the atmosphere and said valve-chamber, a valve having means to control both of said ports and normally tending by the influence of gravity to close the port to said valve-chamber, an inflatable valve-actuating pouch formed of juxtaposed flat sheets of rubberized fine fabric vulcanized together adjacent their peripheries located below said valve, the lower of said sheets resting upon said pouch board and having a central port communicating with said duct whereby admission of air through said duct in conjunction with a partial vacuum maintained in said valve chamber will raise the valve against the action of gravity to close the port in the conduit leading to the atmosphere, simultaneously opening the port leading to the pneumatic to actuate the latter.

In testimony whereof, I have signed my name to this specification.

ADOLPH P. GUSTAFSON.