Oct. 20, 1925. 1,557,978

C. E. CAMERON

WIND INDUCING BELLOWS

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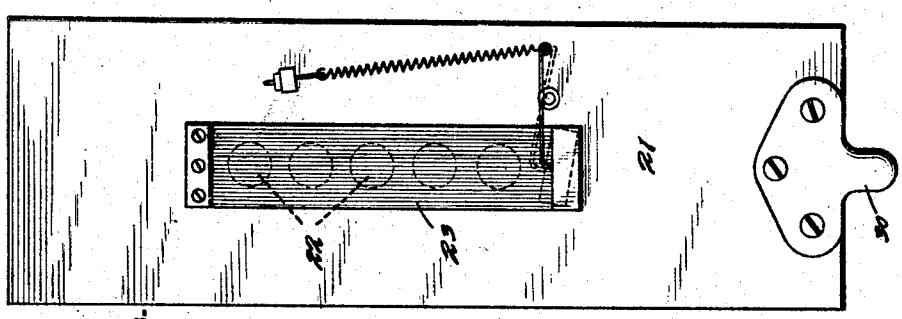


Fig.3.

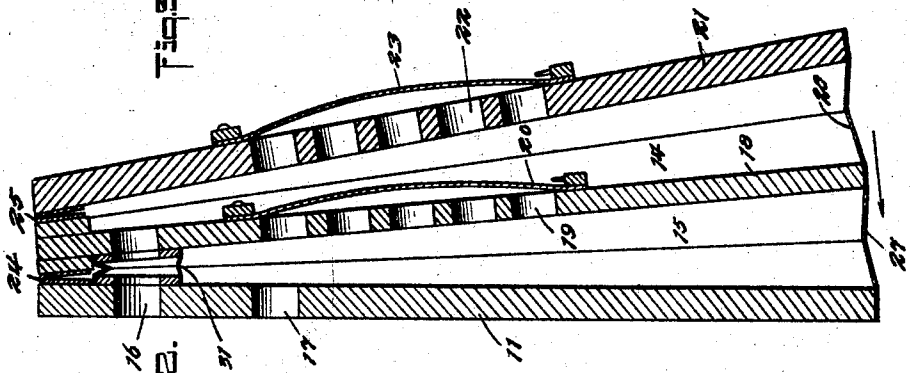


Fig.2.

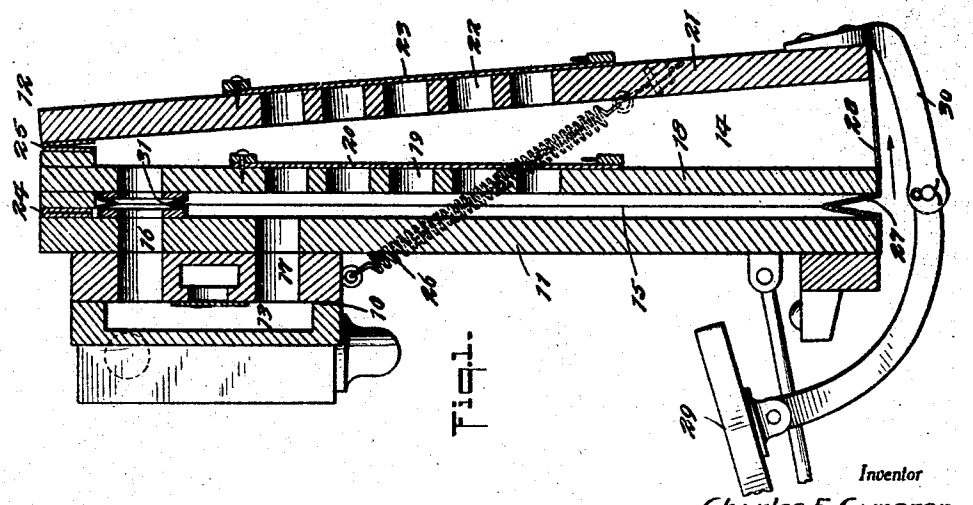


Fig.1.

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UNITED STATES PATENT OFFICE.

CHARLES E. CAMERON, OF EAST ORANGE, NEW JERSEY.

WIND-INDUCING BELLOWS.

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To all whom it may concern:

Be it known that I, CHARLES E. CAMERON, a citizen of the United States, and resident of East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Wind-Inducing Bellows, of which the following is a specification.

The invention relates in general to an improved form of wind inducing device of the type usually employed in autopneumatic musical instruments such as player pianos, and which commonly include a wind-chest, one or more pumping bellows and one or more pedals for actuating the bellows.

In player pianos now in general use, the pivoted pedals are arranged so as to have a movement of about four inches in their downward, bellows-actuating movement. With the type of bellows now in general use skillful and constant care must be exercised in order to maintain a constant, uniform pressure or suction effect which will be of sufficient intensity to operate the instrument and which on the other hand will not be so high in pressure, or low in vacuum, as to cause a stiff, resisted actuation of the mechanism.

In the following description the term pressure is intended to cover any difference in air tension different from atmospheric pressure and while the device selected for specific disclosure operates under negative pressure or vacuum, the invention is of sufficient scope to include those forms of bellows which supply positive pressure to the wind chest.

With the form of bellows now in general use it is believed that the initial movement of the pedal acting on its downward stroke, over approximately the first two inches of its four inch stroke, causes a sudden exhaustion of air from the wind chest, or other compartment to be exhausted, resulting in a quick drop in pressure beyond the ideal playing pressure and that the final movement of the stroke is largely idle and does little if any effective work. This is particularly noticeable in slow pedalling where the instrument is supplied with an unnecessarily low pressure at the beginning of the pedalling stroke but this extreme pressure is not maintained and is quickly lost even prior to the termination of the downward pedal movement. The loss in working pressure is due not only to consumption in doing useful work but is also due to leakage which is quite noticeable at pressures remote from atmospheric pressure. The final movement of the pedal action at best barely retards the rate of return of pressure to normal and it is a usual experience to find that there is no available working pressure in the instrument by the time the pedal has reached the end of its actuating stroke. It is necessary with known forms of instruments to pedal at a relatively rapid rate so as to maintain actuating pressure in the instrument thus requiring the operator to work harder than is theoretically necessary to cause the machine to function. There is the additional disadvantage in that there must be maintained in the instrument a pressure lower than is necessary or desirable to obtain the best playing conditions. This creating of an excess of pressure is fatiguing to the operator and the excess deleteriously affects the sensitiveness of the instrument.

Accordingly the primary object of the invention is to provide in a player piano a simplified form of wind inducing bellows construction in which a substantially uniform working pressure is maintained in the instrument at least during the interval of time from the beginning to the end of the pedalling stroke.

Other objects of the invention are to provide a pedal actuated bellows construction, which will economically convert the muscular activity of the operator's foot into useful working pressure, which will continue to create such pressure as long as the operator's foot is actively disposed; which will tend to minimize the losses occurring heretofore at the low (or high) pressure points, which will tend to equalize pressure conditions in the wind chest during the playing of the instrument and which will permit of the accenting or crashing effects characterizing known forms of player piano wind inducing bellows.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one

form of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings,

Figure 1 is a vertical sectional view taken through the lower part of a player piano, showing a preferred embodiment of the invention installed therein; and showing the position of the parts when the pedal is depressed about one-half of its actuating stroke;

Figure 2 is an enlarged view of the bellows shown in Figure 1 at the start of its collapsing movement and

Figure 3 is a view in elevation of the right hand side of the device shown in Figures 1 and 2.

In the following description and in the claims, parts will be identified by specific names for convenience of expression but they are intended to be as generic in their application to similar parts as the art will permit.

In the dawings there is shown a wind chest 10 of a player piano secured to one side of which is the customary stationary board 11 which extends across the front of the lower portion of the piano. An air exhauster 12 is positioned on the rear side of the board 11 for withdrawing air from the conduit 13 in the wind chest 10 as is well known in autopneumatic musical instruments.

The exhauster 12 is in effect two conventional forms of bellows and will be identified herein as a primary bellows 14 and a secondary bellows 15. The primary bellows exhausts the conduit 13 through the open passageway 16, which extends through the board 11 and through the secondary bellows. Smilarly the secondary bellows 15 exhausts the air in the conduit 13 through the passageway 17 formed in the board 11.

The secondary bellows 15 includes the base board 11 as its fixed side and a movable side 18 which constitutes a floating partition between the two bellows. Communication is provided between the bellows chambers by a plurality of ports 19 which are normally closed by a spring pressed flapper fabric 20. This construction forms a one-way valve between the bellows and is a well known construction. The partition 18 forms the relatively fixed side of the primary bellows and a pivoted side 21 constitutes the outer, movable side of the exhauster and the movable side of the primary bellows. The side 21 is similarly provided with escape ports 22 normally covered by the spring pressed flapper fabric 23. The side 18 is pivotally connected at its upper end to the board 11 by means of a hinge construction 24 and the side 21 is similarly connected to the side 18 by a hinge construction 25. The exhauster is returned to its normal, collapsed position by return springs one of which 26 is shown in Figure 1 and which spring connects the wind chest with the side 21. The bellows are of conventional form with the side 18 connected to the board 11 by an accordion fabric 27 and the boards 18 and 21 are similarly connected by fabric 28, but the fabric is preferably of one piece and extends from the fixed board 11 to the movable side 21.

The exhauster is actuated by means of a foot pedal 29 connected through suitable links 30 with the side 21 as is well known in similar constructions.

In the preferred showing of the invention where the passageway 16 is employed to provide a direct connection between the conduit 13 and the primary bellows, it is suggested that a flexible conduit 31 be extended across the secondary bellows so that the passageway 16 may be used exclusively to maintain direct communication between the primary bellows and the wind chest. It is suggested however that the passageway 16 be omitted, in which case communication between the primary bellows and the wind chest is provided through the ports 19 and the secondary bellows 15.

In operation and assuming that both bellows are in collapsed position and that the pedal is elevated, the operator will start to press down on the pedal with the usual powerful force characterizing the initial part of a pedalling stroke. This will cause the outer board 21 to move outwardly from its normal collapsed position and in the direction indicated by the arrow in Figure 1. During the initial part of the downward movement of the pedal, say for the first two inches, the primary bellows will be drawing air either directly from the wind box through the conduit 16, or therefrom through the secondary bellows. During this time the secondary bellows will remain idle and in collapsed position. At about the end of the two inch initial movement the accordion fabric 28 will be stretched to its limit and the parts will be approximately in the position shown in Figure 1. Continuing the downward pressure of the pedal will cause the fabric 28 to act as a flexible connection and to cause the floating side 18 to move outwardly following the side 21 and thus act to distend the secondary bellows. The secondary bellows will then begin to function drawing air from the wind box through the passageway 17. It will be also apparent that while the secondary bellows is thus drawing air from the wind box, the primary bellows is also functioning so that during the final movement of the operator's

foot in effecting the actuating stroke, both bellows are simultaneously drawing air from the wind-box.

Considering the exhauster as one bellows it is apparent that during the first two inches of the pedal stroke the wind chest is subjected to the withdrawing action of an exhausting chamber of increasing but relatively small volumetric capacity and that during the last two inches of the stroke the volumetric capacity of the chamber is considerably increased.

While only two bellows are disclosed it is obviously possible to increase the number of floating partitions and thus provide any number of bellows which can be brought into sequential operation during the actuating stroke of the pedal or pedals. When the exhauster has been distended to the limit of its movement the operator releases pressure on the pedals and the return springs act to collapse the bellows as indicated by the arrow in Figure 2. During the return movement of the sides 18 and 21 the air contained in the bellows opens the valves 20 and 23, permitting the escape of the air in both devices as is well known in similar bellows of the single acting type now in general use. With the return of the parts into or towards their initial position, the operator may again depress the pedals and this operation is continued at a rate to maintain the requisite pressure in the wind box.

By means of a device of this character it is possible to maintain a relatively constant working pressure in the wind-box by a relatively slow, unhurried movement of the pedals. When so actuated the pressure in the wind box is maintained substantially constant and at a pressure sufficient to actuate the instrument and even a crash effect may be produced without necessarily maintaining the irregular, low inefficient pressure characterizing the actuation of known forms of similar instruments.

Having thus described my invention, I claim:

1. In a wind inducing device for self-playing musical instruments, the combination of a wind-chest, a front board fixed thereto, a secondary bellows on the front board opposite the wind-chest, and with said front board as one side of the secondary bellows, an air passageway in said board placing said secondary bellows in communication with the wind chest, a primary bellows with a pivotally mounted floating board common to both bellows constituting the movable side of the secondary bellows and a relatively fixed side of the primary bellows, and another board constituting the movable side of the primary bellows, both of said movable boards provided with valve controlled ports extending therethrough and a pedal operatively connected to the movable side of the primary bellows and acting through the primary bellows when distended to move the movable side of the secondary bellows.

2. In a wind-inducing device for self-playing musical instruments, the combination of a wind chest and a pumping air exhauster communicating therewith, said exhauster including a pair of bellows, each provided with a movable side, a valve controlled port providing communication between the bellows, a flexible connection between said movable sides providing for a free movement of one of the sides before the other side is moved and means for moving one of the sides and for acting through the flexible connection to move the other side whereby one bellows is caused to function in advance of the other.

3. A wind inducing device including a fixed board and two movable boards disposed on one side of the fixed board, flexible members connecting the boards with each other, the fixed board and the next adjacent movable board coacting to form a secondary bellows and the movable boards coacting to form a primary bellows and power means connected to the outer movable board to move the movable boards successively away from the fixed board and thus cause both bellows to function.

4. In a player piano, the combination of a wind-box, a pedal having an actuating movement in one direction, a primary bellows and a secondary bellows both functioning when operatively disposed to withdraw air from the wind box, said primary bellows connected to the pedal during the initial part of said movement to be actuated by the pedal while the secondary bellows remains idle, and means for connecting both said bellows to said pedal during the final part of said movement.

5. In a wind inducing device for self-playing musical instruments, the combination of a wind chest, a muscularly actuated power means having an operative movement in one direction, a plurality of air exhausting means actuated by said power means and means for successively bringing the different exhausting means into operative relation to the wind chest whereby all of the available muscular power during the initial part of said operative movement is concentrated on causing one of said exhausting means to function and the muscular power during a period following said initial part is caused to act on more than one exhausting means and thus cause a plurality of exhausting means to function during the final part of said operative movement.

6. In a player piano, the combination of a wind-box, a pair of bellows both connected to withdraw air from the wind box on an opening movement of the bellows, means

for causing each bellows to function and means for delaying the opening movement of one of the bellows for a period of time following the start of the opening movement of the other bellows.

7. In a player piano, the combination of a wind box, a pair of bellows each connected to withdraw air from the wind box, an actuating pedal operatively connected directly to one of the bellows to cause the same to function as soon as the pedal is moved on its actuating stroke, and means providing a delaying connection between the pedal and the other bellows whereby said other bellows is permitted to remain idle during the initial movement of the pedal and is actuated after a time interval following the actuation of the bellows connected directly to the pedal.

8. In a player piano, the combination of a wind box, a bellows normally having relatively small volumetric capacity and communicating with said wind box to withdraw air therefrom, and means mechanically connected to and controlled by the movement of a side of said bellows for withdrawing air from the windbox and thus act in addition to the bellows.

9. An air exhauster including a musculary actuated power member having an operative movement in one direction, a member provided with a space to be exhausted, a plurality of instrumentalities for exhausting the air pressure in said space and means operatively connecting said instrumentalities with said power member when moving in one direction and including a delaying connection between the instrumentalities for causing one to start to function in advance of the other.

10. An air exhauster including in order a fixed side and two movable sides, flexible means connecting the sides to form two bellows and exhauster actuating means connected to the outer movable side to distend both bellows.

11. An air exhauster including a plurality of bellows having a common side and means for distending one of the bellows and acting through the distended bellows for distending the other bellows.

Signed at Newark in the county of Essex and State of New Jersey this 2nd day of August A. D. 1922.

CHARLES E. CAMERON.