April 8, 1952 C. E. WETZLER 2,592,220

REED INSTRUMENT AND METHOD OF MANUFACTURING SAME

Filed May 15, 1947 3 Sheets-Sheet 1

Fig-1

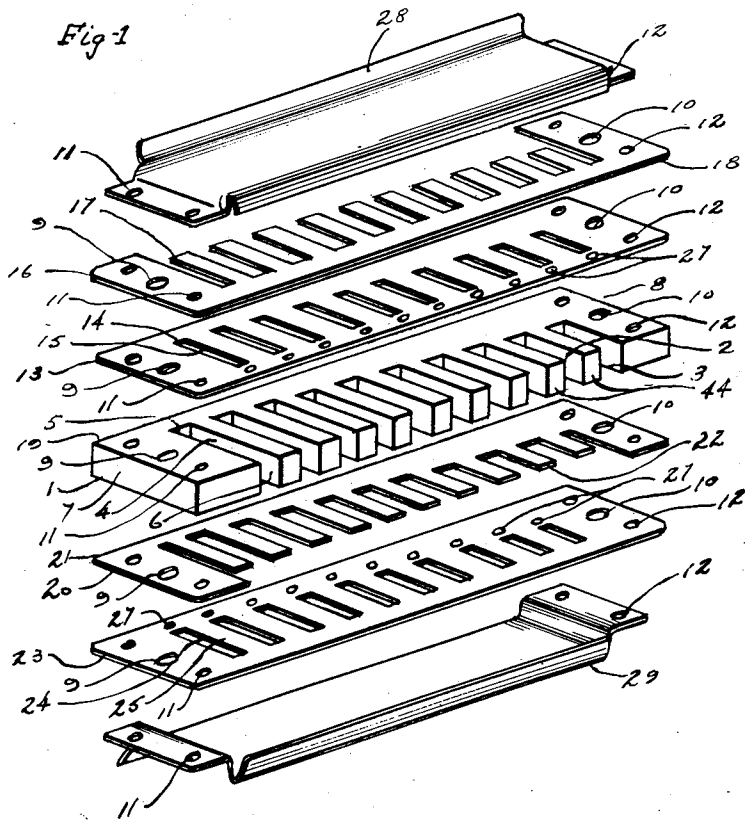


Fig-2

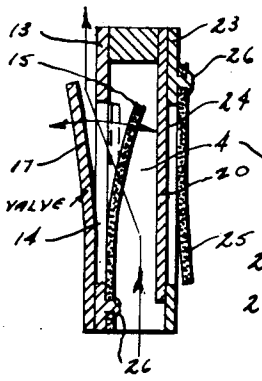
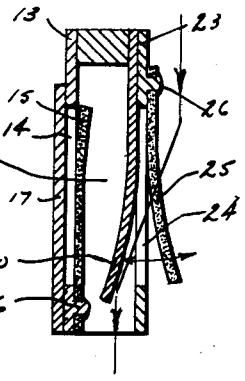


Fig-3



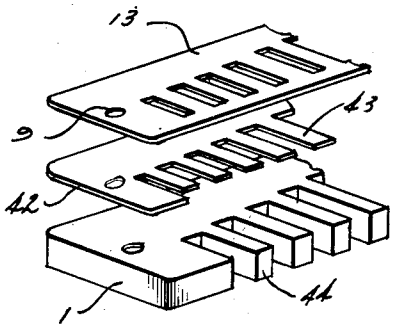


Fig-5

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REED INSTRUMENT AND METHOD OF MANUFACTURING SAME

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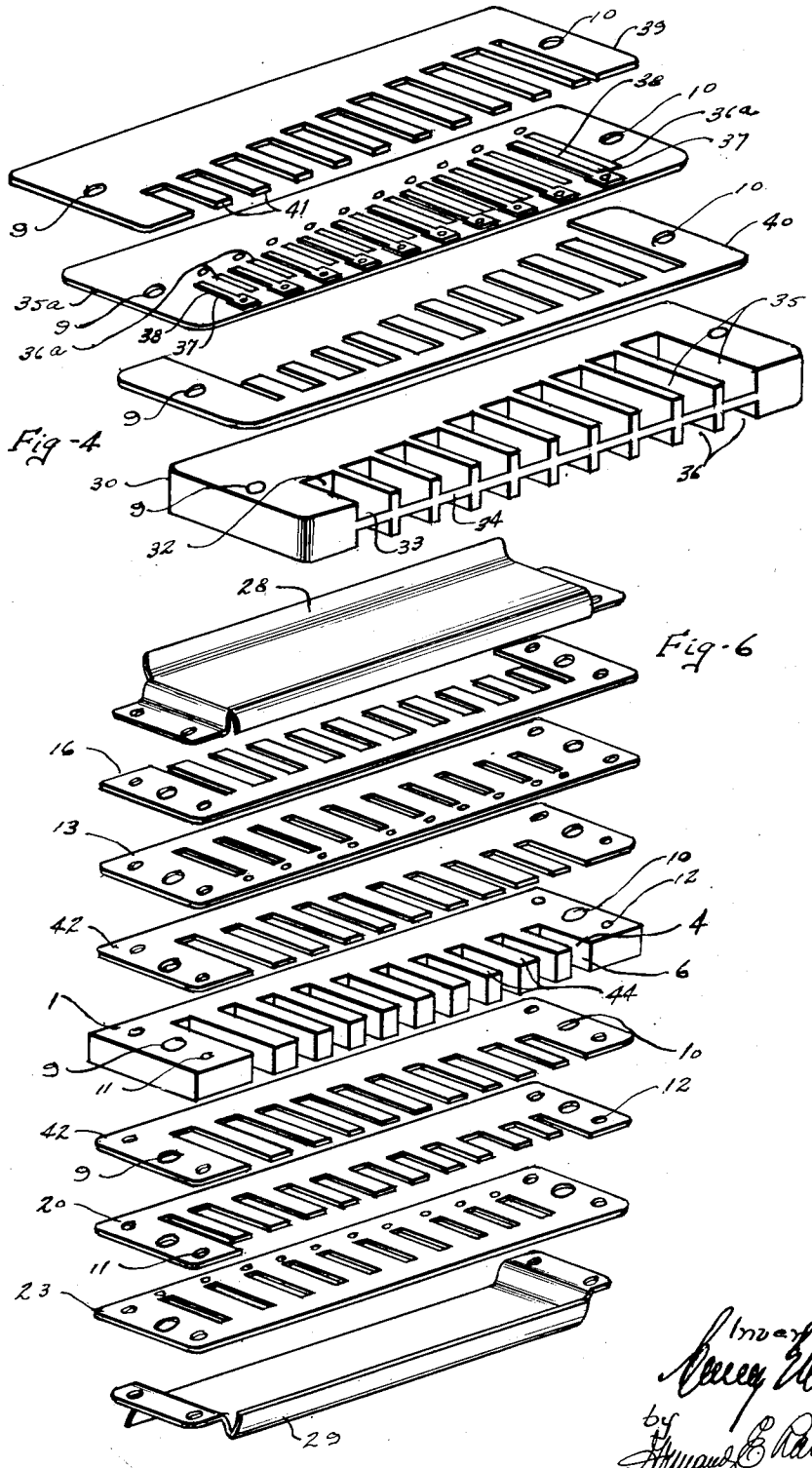


Fig-4

Fig-6

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REED INSTRUMENT AND METHOD OF MANUFACTURING SAME

Filed May 15, 1947 3 Sheets-Sheet 3

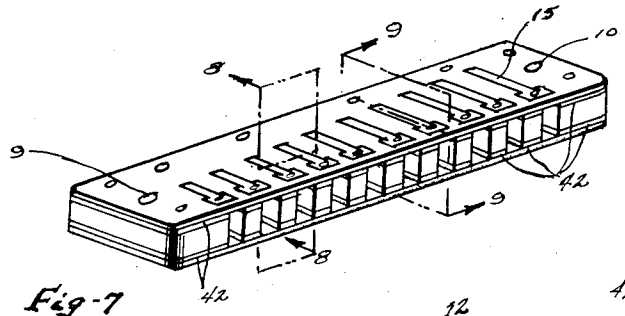


Fig-7

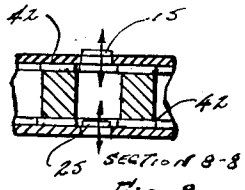


Fig-8

Fig-9

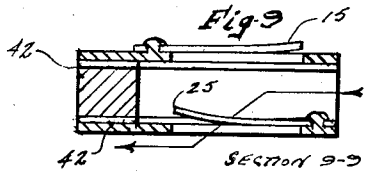


Fig-10

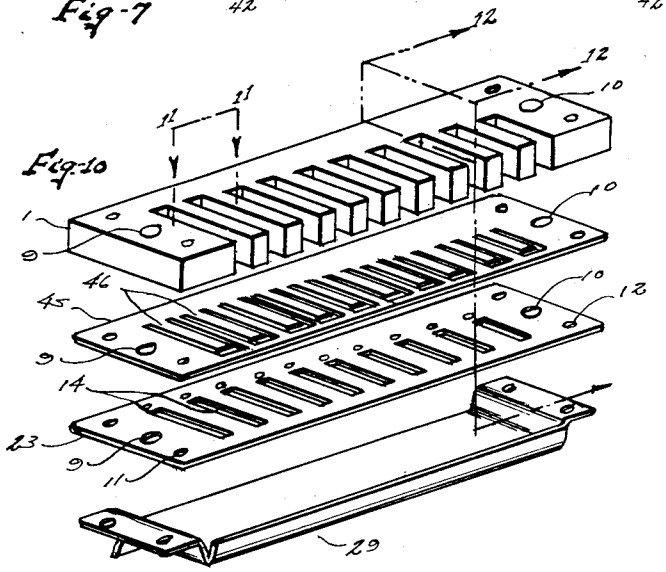
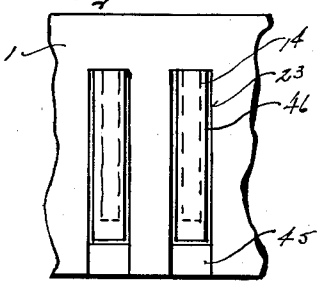
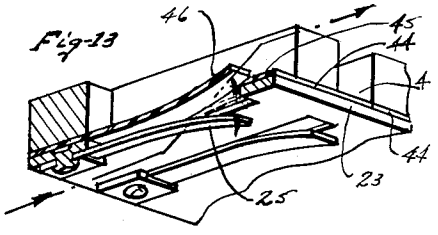


Fig-11



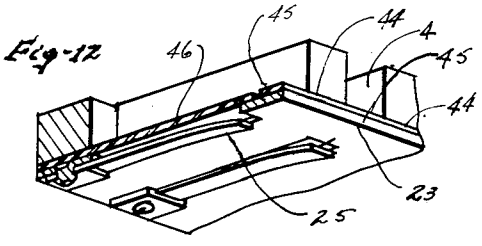
VIEW 11-11

Fig-13



SECTION 12-12
IN MOTION

Fig-12



SECTION 12-12
AT REST

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Patented Apr. 8, 1952

2,592,220

UNITED STATES PATENT OFFICE

2,592,220

REED INSTRUMENT AND METHOD OF MANUFACTURING SAME

Charles E. Wetzler, Long Island City, N. Y.

Application May 15, 1947, Serial No. 748,153

4 Claims. (Cl. 84—377)

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This invention relates to musical reed instruments and more particularly to harmonicas.

It has been common practice to manufacture harmonicas in the following manner: A central body has a number of air chambers which are closed at the rear and open at the front or mouth part of the instrument. The top and bottom of said central body are covered by reed plates or carrier plates containing reeds arranged so that one blow reed and one draw reed face each other within each air chamber. For the protection of the reeds, a pair of covers were provided to permit the harmonica to be slid smoothly between the lips of the player.

Since the musical sound created in a harmonica is dependent on the smooth flow of air through the air chamber and the vibration of the reeds caused thereby, it can be seen that the production of the desired or required air pressure within said air chamber will decide the acoustical efficiency of the instrument. It is necessary to produce air pressure within said air chamber when the blow reed is to operate and suction when the draw reed is to vibrate. Because of one set of said blow reeds and draw reeds being arranged adjacent to one common air chamber, blowing into one air chamber of the instrument not only causes the blow reed to vibrate but also causes the draw reed to bend away from this air chamber, thus increasing the normal air gap around said draw reed with the resulting loss of air pressure. Producing suction within said air chamber, by inhaling, causes said draw reed to vibrate but also causes the blow reed to bend into said air chamber and thus widen the normal air gap around the blow reed which results in reducing the suction and in air turbulences and eddy air currents to be set up within said air chamber.

This air leakage in either direction as described causes volumetric losses of air, losses of power, and energy, and makes the harmonica inefficient and difficult to play.

In an inexpensive type of harmonica no provision is made to prevent this air leakage. However, in the expensive and better quality instruments, attempts have been made to eliminate this air leakage by means of valves made of leather strips which are glued on each reed plate above each reed in order to close automatically the complete slot of the reed which is not in vibration.

This arrangement of using leather strips has been found to be unsatisfactory due to the fact that each leather valve must be cut individually

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to fit properly the length of each reed, since reeds are of different lengths and must be lined up properly above or below each reed slot and then glued to the reed plate.

All these operations require skill, time and considerable care which adds to the final cost of the instrument. However, in spite of careful assembly, the harmonica may steadily lose its efficiency during use due to the fact that moisture from the mouth of the player causes the leather strips to curl and lose their flat contact with the reed slots, resulting in improper sealing of the reed slots. The changing conditions of temperature and humidity cause a loosening of the grip of the glue used to hold the leather strips, which soon will go out of alignment or may be lost altogether, necessitating continued repairs, alignment, and replacement of the leather strips.

In addition to the air losses mentioned above, air pressure is also lost through the gaps that exist between the body and the reed plates and may be caused by any one or all of the faults set forth hereinafter.

Intermittent exposure to variations in moisture and temperature causes the wood of the body to warp, swell or shrink, thus creating the leakage through air gaps between the body and the reed plate. In a similar way, plastic bodies are not completely even on the surface due to shrinkage in the molding process.

Also, the material of the reed plates varies in gauge and flatness, thus making an uneven surface in contact with said central body. This lack of flatness is aggravated by the process of extruding rivets required for attaching reeds to the plates and by distortion of the reed plate due to the riveting blows which spread the rivet head above the reed. Clamping or nailing the reed plate to the body does not overcome this distortion but causes in addition more air gaps of various degrees at each air chamber and therefore irregular response of the vibrating reeds. Harmonicas of this construction are very difficult to play and control. In addition, these nails lose their grip in varying degrees as time goes by, get loose and the harmonica quality steadily deteriorates.

The main object of this invention is to eliminate completely air leakage in harmonicas.

It is another object of this invention to provide a harmonica having a multiple but one-piece valve unit which is inexpensive to manufacture and to assemble on the harmonica body of either the diatonic or the more complicated chromatic type of harmonica.

Still another object of this invention is to provide a harmonica construction which eliminates air leakage between the harmonica body and reed plate by utilizing a gasket of an elastic and compressible material arranged between the body and the reed plates.

Still another object of this invention is to provide a harmonica having the combination of multiple valves and gaskets arranged between the central body and a reed plate to eliminate any air leakage between chambers of the body, between the body and the reed plate, and around the inactive reed.

Other objects and advantages will appear from the following description considered in connection with the accompanying drawings in which Fig. 1 is an exploded perspective view of my harmonica showing the relative position of the various compenents; Fig. 2 is a cross-sectional view of an assembled harmonica with cover removed to show the operation of the multiple valve when the blow reed is vibrating; Fig. 3 is a cross-sectional view of an assembled harmonica similar to Fig. 2, to show the operation of the opposing multiple valve when the draw reed is vibrating; Fig. 4 is an exploded view of the upper half of a chromatic harmonica with cover removed to show the relative position of the multiple valves and a chromatic reed plate; Fig. 5 is a perspective view of a section of a harmonica showing the arrangement of a one-piece, comb-like gasket between the reed plate and the body of said harmonica; Fig. 6 is an exploded view of a harmonica showing the relative position of the component parts; Fig. 7 is an assembled perspective view of the harmonica with cover removed to show the relative position of the gasket; Fig. 8 is a cross-sectional view of the harmonica of Fig. 7 taken along the lines 8—8; Fig. 9 is a cross-sectional view of the harmonica of Fig. 7, taken along the lines 9—9; Fig. 10 is an exploded perspective view of the lower half of a harmonica showing the relative position of the multiple valve and gasket unit; Fig. 11 is a plan view of a section 11—11 of the harmonica shown in Fig. 10; Fig. 12 is a cross-sectional view of the harmonica of Fig. 10 taken along the lines 12—12 with the reed at rest; and Fig. 13 is a similar view to Fig. 12 with the reed in motion.

Referring now to the drawings and in particular to the harmonica shown in Figs. 1, 2 and 3, this harmonica comprises a body 1 which may be made of wood, plastic or other suitable material. At regularly spaced intervals along said body 1 are cut rectangular grooves 2 constituting the air chambers which are usually of graduated lengths from the first groove 3 to the last groove 4. The rear ends 5 of said grooves are closed while the front ends 6 are open. At the thick end portions 7 and 8 of said body 1 are located single locating holes 9 and 10 respectively, and fastening holes 11 and 12 arranged in any suitable fashion or number near said locating holes 9 and 10 of said body 1.

Above said body 1 is located a reed plate 13 having slots 14 of graduated lengths in which are contained blow reeds 15 adapted to vibrate freely within said slots 14. Above said reed plate 13 is located a one-piece multiple valve unit 16 comprising valves 17 cut out and arranged in graduated lengths to match the reed plate slots 14 to form a comb having its one-piece back 18 aligned with the front ends 6 of said body 1 while the tongues 17 of said one-piece multiple valve are aligned with the closed ends 5 of said body 1. The tongues or valves 17 are dimensioned to overlap the reed slots 14 sufficiently.

Beneath said body 1 is placed a one-piece multiple valve unit 20 of similar construction to the above-mentioned valve unit 16 but reversed in position so that its one-piece back 21 is aligned with the rear end 19 of said body 1, while the tongues 22 of said one-piece multiple valve unit extend towards the open ends 6 of said grooves 4.

Beneath said one-piece multiple valve unit 20 is placed a reed plate 23 having slots 24 of graduated lengths with draw reeds 25 arranged to vibrate freely within said slots 24. Blow reeds 15 and draw reeds 25 are attached within their respective slots 14 and 24 by means of rivets 26 showing at the rear of 27, and as shown in Figs. 2 and 3.

Locating holes 9 and 10 are located in the end portions 7 and 8 of the respective reed plates 13 and 23 and the respective valve units 16 and 20 so that each aforementioned unit may be lined up for assembly with the locating holes 9 and 10 of the body 1. Corresponding fastening holes 11 and 12 in each unit are automatically lined up to fasten the entire assembly together. Upper cover 28 and lower cover 29 are then fastened to the top and bottom of the assembly by suitable means through fastening holes 11 and 12 to complete the harmonica.

Referring now to the drawing of the upper portion of the chromatic harmonica shown in Fig. 4, this chromatic harmonica comprises a body 30 having grooves 31 spaced at regular intervals along said body 30 and of graduated lengths which are closed at one end 32 and open at the other end 33. A web 34 running the length of the body 30 divides said grooves 31 into upper and lower sections 35 and 36, respectively. Said web 34 may be recessed from the front edge 33 of said body 30 or it may be flush with said front edge 33 as shown in the drawing. A chromatic reed plate 35*a* has parallel slots 36*a* arranged equidistantly in graduated lengths along the length of said chromatic reed plate 35*a*. Reeds 37 are arranged alternately on opposite sides of said reed plate 35*a* and riveted at opposite ends of alternate slots 36*a* so that the free ends 38 face in opposite direction in alternate slots 36*a* and swing freely within said slots 36*a*.

One piece multiple valve units 39 and 40, having tongues 41, graduated in length and adapted to cover and overlap said reed slots 36*a* are placed on opposite sides of said chromatic reed plate 35*a* with said tongues 41 of each valve unit 30 and 40 extending in directions opposite each other. Locating holes 9 and 10 on the respective edges of the body 30, the valve units 39 and 40 and the chromatic reed plate 35*a* are used to line up the parts for quick assembly as hereinbefore set forth.

Referring now to the drawings of a harmonica with a gasket shown in Figs. 5, 6, 7, 8 and 9, this harmonica comprises a body 1 having the above-mentioned grooves or air chambers 4 therein, a gasket 42 made of any suitable elastic and compressible material as blanked out in the form of a comb so that the teeth 43 of said comb-like gasket are in alignment and contact with surface portions 44 of body 1 between grooves 4 and with the rest of complete surface of said body 1 not occupied by grooves 4. On top of this gasket 42 is placed the reed plate 13. Again locating holes 9 and 10 line up the various parts of the harmonica as shown more particularly in the ex-

ploded view Fig. 6. Here gaskets 42 are placed on opposite sides of the body 1 while the remainder of the components are arranged in the manner set forth above.

In Fig. 7 said harmonica with gaskets 42 is shown assembled without the covers 28 and 29.

The cross-sectional view of Fig. 7 shown in Fig. 8 illustrates how the leakage of air between adjoining air chamber grooves 4 is prevented while the cross-sectional view shown in Fig. 9 shows how the leakage of air to the outside between reed plate 15 and body grooves 4 is eliminated by the aforementioned gaskets 42.

Referring now to the exploded drawing of the lower half of a harmonica shown in Fig. 10 this harmonica includes another embodiment comprising a combination multiple valve and gasket unit 45 which is blanked out of a sheet of suitable gasket material. Instead of cutting out apertures to match the grooves 4 in the body 1, a U-shaped cut is made at the position of each groove 4 to create a series of prongs 46 which are designed to act as valves over slots 14, while the remainder of the material functions as the air sealing gasket 42 as described above.

Fig. 11, taken along the lines 11—11 of Fig. 10 shows the slot 14 in the reed plate 23 with the valve prongs 46 overlapping the slots 14 of the reed plate 23 by a proper margin. The cross-sectional views of Figs. 12 and 13, taken along the lines 12—12 shows the relative position of the draw reed 25 and the gasket valve portion 45 when said draw reed 25 is at rest and when it is vibrating.

In Fig. 12 the gasket valve prong 46 is shown in the closed position with the draw reed 25 at rest. When the draw reed 25 begins to vibrate, the gasket valve prong 46 opens outwardly to permit free movement of the vibrating draw reed 25 while the remainder of the gasket 45 continues to close the space between the surface portions 44 and the reed plate 23 and thus prevent air leakage into adjoining chamber grooves 4 and to the outside.

These one-piece multiple valve units as shown in Fig. 1 can be blanked out in one power press operation and may be made of stainless steel of the proper thickness and hardness, beryllium copper, or any other non-corrosive metal having a predetermined temper or having received these properties after heat treating, suitable for reacting quickly to air movements and changes in air pressure. In addition, the combination of two or more layers of material can be used, for example, two thin layers of fine leather and non-corrosive metal, which will prevent the leather from curling after being moistened. Also, plastic material, either molded or blanked out from sheet may be used.

The operation of the device is as follows:

When the player blows into the harmonica, the air passes through the groove 4 of the body 1 as shown by the arrow in Fig. 2, and pushes the blow valve 17 open which permits the passage of air and also the free vibration of the blow reed 15 within the slot 14 of the blow reed plate 13. This same flow of air causes the draw valve 20 to close the slot 24 in the draw reed plate 23 and thus prevent loss of air through said slot 24. When the player inhales, he draws the air out of the groove 4 which reverses the flow of air in the direction of the arrow shown in Fig. 3. This creates a suction within said groove 4 and thus the draw valve 20 is pulled and bent into the groove 4 and away from the slot 24 to permit a flow of air through said slot 24 and the free vibration of the draw reed 25 within said slot 24 of the draw reed plate 23. This suction in said groove 4 now pulls the blow valve 17 tightly against the blow reed plate to seal the slot 14 in said blow reed plate 13 and thus prevent the influx of air from said slot 14 while the blow reed 15 remains inactive. There is sufficient spring tension in the valve material to maintain said valves 17 and 20 in the closed position when no air is flowing in either direction through the air chamber grooves 4.

The operation of the valves is similar in the multiple valve and gasket combination described above except that the valve 46 is cut out of the gasket 45 and thus not only seals against the possible air leakage around the inactive reed but also prevents air leakage from one air chamber to a neighboring air chamber and to the outside as set forth above.

As will be seen from the above description, the invention discloses a harmonica having a one-piece multiple valve unit simple to produce and assemble which permits the manufacture of excellent quality harmonicas in an inexpensive manner.

In addition to the use of said multiple valve unit, or independently therefrom, a gasket is employed which prevents air leakage from air chamber to air chamber and also prevents air leakage to the outside through the gaps that otherwise exist between the reed plate and body of the instrument after final assembly.

The combination of the valve unit and gasket either as separate elements of the assembly or as one combined unit provides a new harmonica with quick and easy response which the player can control with less effort on his part due to the elimination of power and energy losses which such air leakage entails.

The cost of producing said new harmonica is reduced to a new low level by mass production technique which is now possible with my new method of construction due to the fact that the valves may be punched out in standard one-piece units and also since the gasket material is compressible, there is no longer the need for the expensive process of finishing the body to obtain a uniform fit throughout the instrument. The gasket will fill in any one and all irregularities of the reed plates or body whether they are made of wood, plastic or any other material and also whether the body is machined, molded or cast, precision is no longer a prime requisite.

These new features present a harmonica which has an easy, quick and uniform response over the complete range of the instrument whether of the diatonic or chromatic type and a minimum amount of air is sufficient to produce musical sound in a clear undisturbed tone.

While, in disclosing the principles of my invention, and its preferred embodiment, I have described various detailed structure and relationship, it will be understood that such embodiment and details are given by way of example only and not as limiting the scope of my invention.

I claim:

1. In a reed instrument, the combination of a body having air chambers, a number, including one, of reed plates having spaced apertures and being mounted on said body, a plurality of blow and draw reeds respectively provided on said reed plates in coordination with said apertures and at least one gasket having apertures corresponding to the air chambers of said body and the

apertures of the reed plates and being adapted to seal air gaps between said body and said reed plates.

2. In a reed instrument, the combination of a body having air chambers, a number, including one, of reed plates having spaced apertures and being mounted on said body, a plurality of blow and draw reeds respectively provided on said reed plates in coordination with said apertures, at least one multiple valve unit having spaced tongues adapted through their location and size to seal during actuation of any one of said reeds the apertures coordinated with the non-actuated reeds and at least one gasket having apertures corresponding to the air chambers of said body and apertures of the reed plates and being adapted to seal air gaps between said body and said reed plates.

3. In a reed instrument, the combination of a body having air chambers, a number, including one, of reed plates having spaced apertures and being mounted on said body, a plurality of blow and draw reeds respectively provided on said reed plates in coordination with said apertures, and at least one multiple valve unit made of compressible material adapted to seal air gaps between said body and said reed plates and having spaced tongues adapted through their location and size to seal, during actuation of any one of said reeds, the apertures coordinated with the non-actuated reeds.

4. In a reed instrument the combination of a body having air chambers, a number, including one, of reed plates having spaced apertures and being mounted on said body, a plurality of blow and draw reeds respectively provided on said reed plates in coordination with said apertures, and means adapted to prevent during actuation of any one of said reeds the leakage of air at points different from the air gap between said actuated reed and the edge of the coordinated aperture, in which the means adapted to prevent leakage of air comprises at least one multiple valve unit including a plurality of valves arranged in graduated lengths matching the reed plate and a gasket covering the reed plate having apertures corresponding to the air chambers of the body and to the apertures of said reed plate.

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