United States Patent

McKenzie

[15] **3,674,910**

[45] **July 4, 1972**

[54] CHROMATIC HARMONICA

[72] Inventor: **James G. McKenzie,** P.O. Box 1982, Orange, Calif. 92668

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[21] Appl. No.: **47,010**

[52] **U.S. Cl.** **84/377**
[51] **Int. Cl.** **G10d 7/12**
[58] **Field of Search** 84/375, 377, 378, 379

[56] **References Cited**

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Primary Examiner—Richard B. Wilkinson
Assistant Examiner—John F. Gonzales
Attorney—Eric P. Schellin

[57] **ABSTRACT**

A chromatic harmonica employing a pair of independently movable, manually actuated valve slides with predetermined patterns of lands and apertures formed therein. Such slides are disposed behind the mouthpiece and before the comb and reed plates in the path of flow for the breath expelled by the person playing this instrument. The comb and reed plate is designed so that each cell in the comb is subdivided into a plurality of wind cells with a separate reed for each wind cell, and four wind cells are exposed to each opening in the mouthpiece of the harmonica. By proper manipulation of the pair of valve slides three of the four wind cells operatively associated with each opening are blocked by appropriate lands in the slides; thus, only the single reed within the selected wind cell is placed in communication with the mouthpiece to receive the breath expelled thereinto. Consequently, with this unique configuration of coacting elements, the instant harmonica may be played in a unidirectional, "all-blow," or "all-draw" fashion approximating the operation of a woodwind instrument. Furthermore, such harmonica is capable of producing all of the notes of the chromatic scale with a more nearly consistent smoothness of transition from one note to the next, and more trills are available.

9 Claims, 23 Drawing Figures

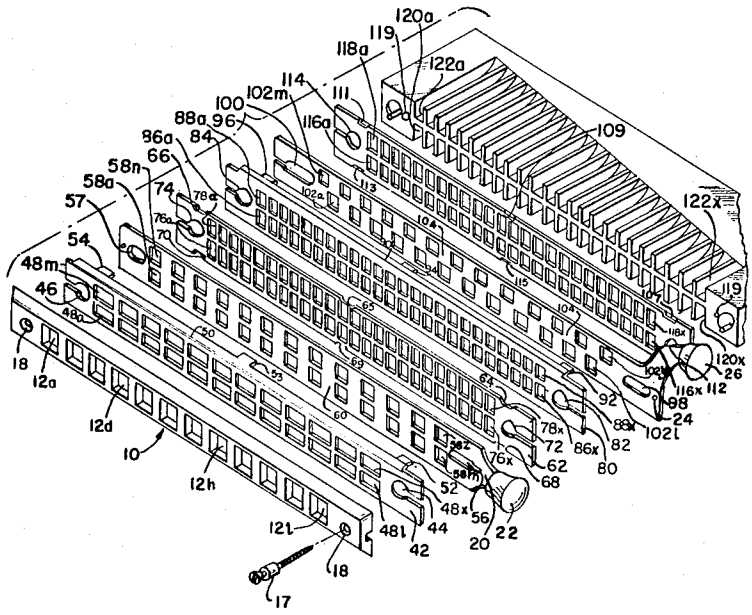

FIG. 1.

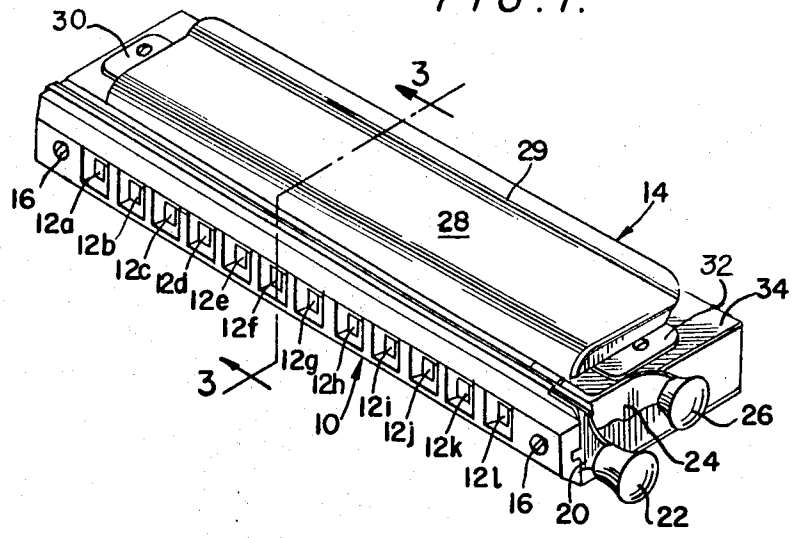

FIG. 2.

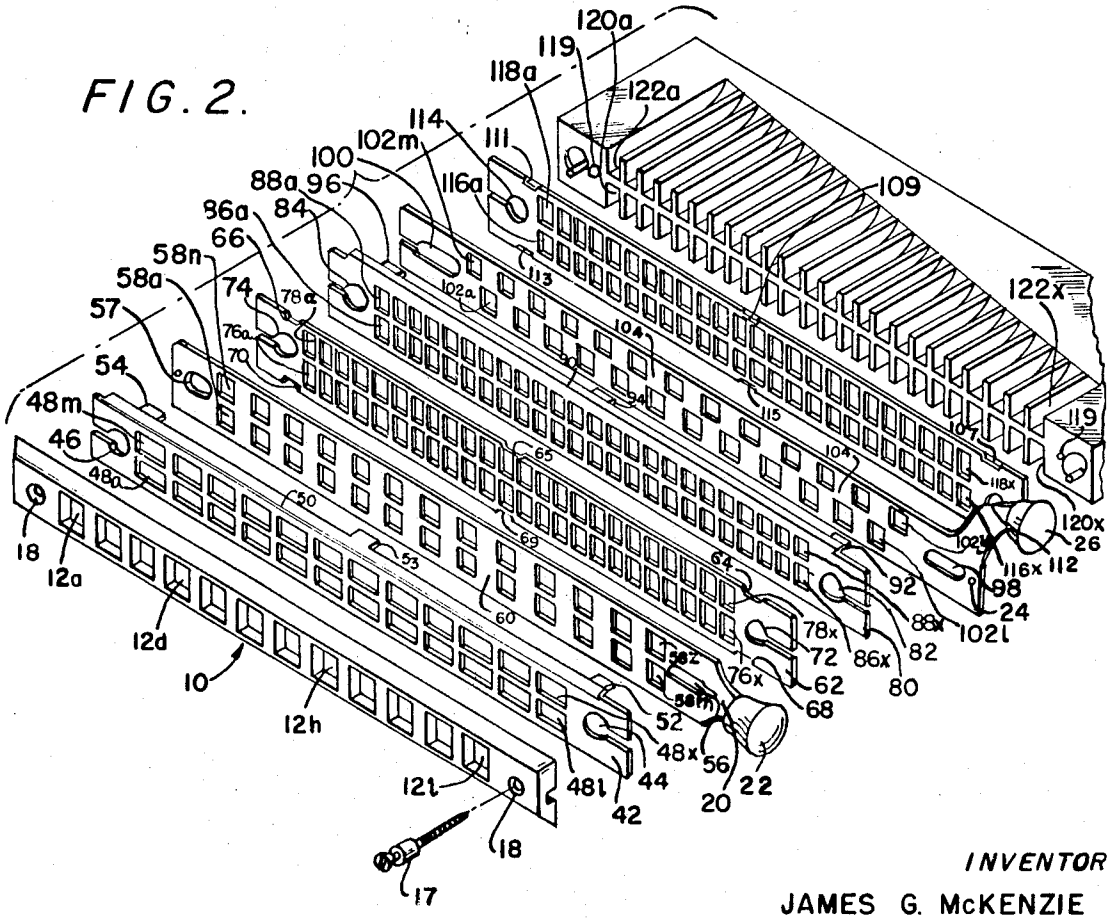

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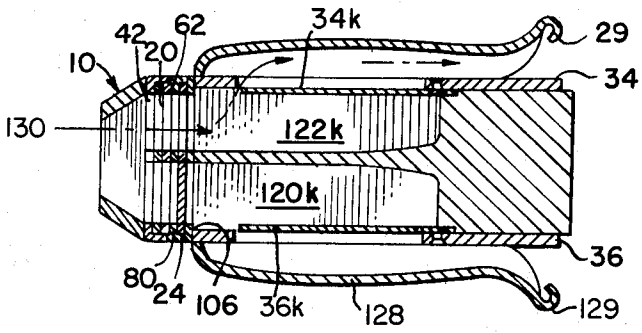
FIG. 3.



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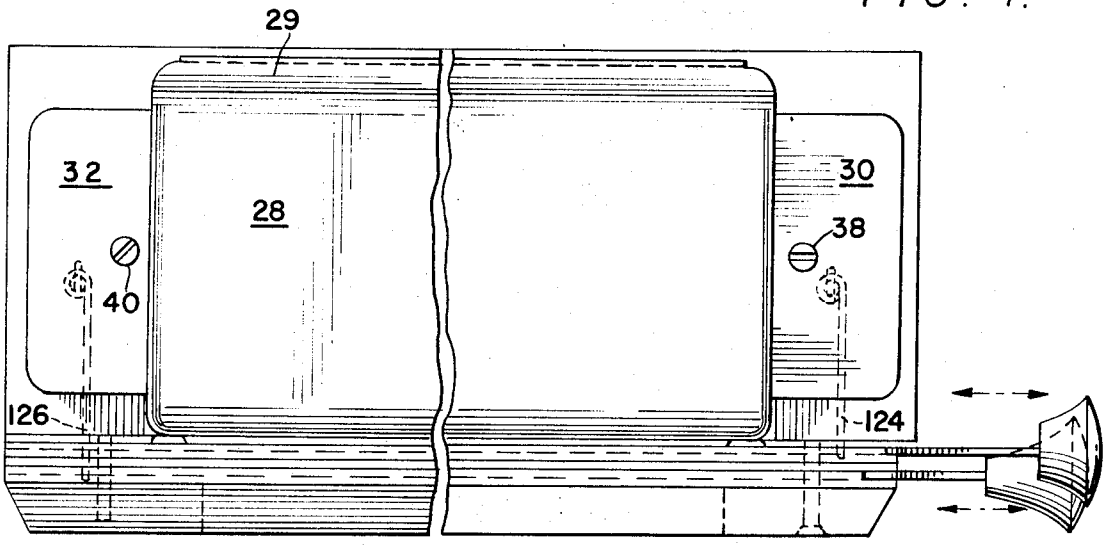

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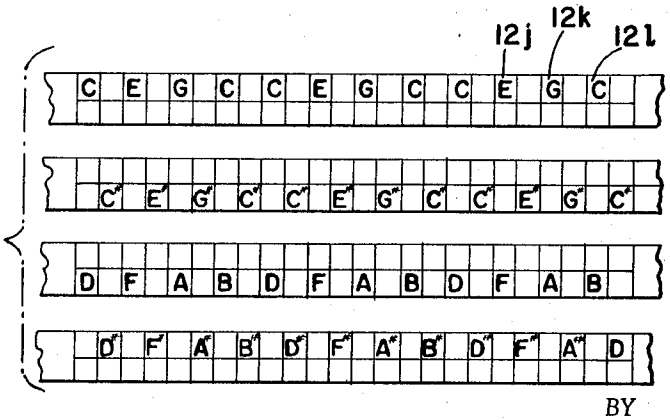

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FIG. 6.

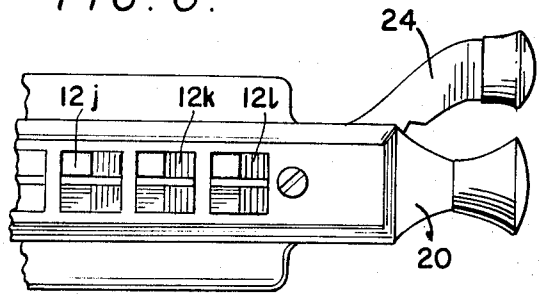
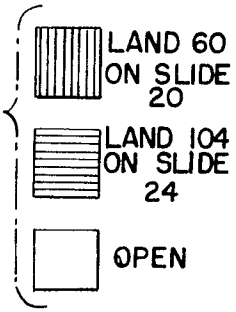


FIG. 10.



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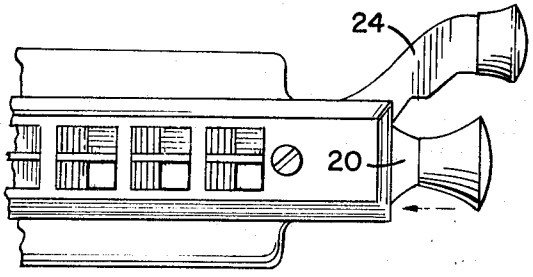
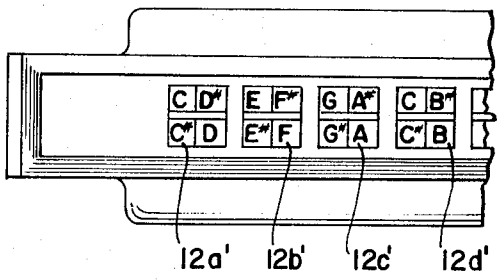


FIG. 11.



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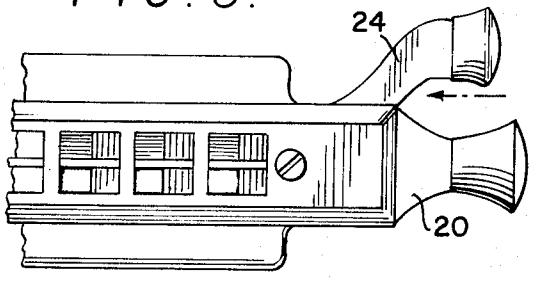

FIG. 12.

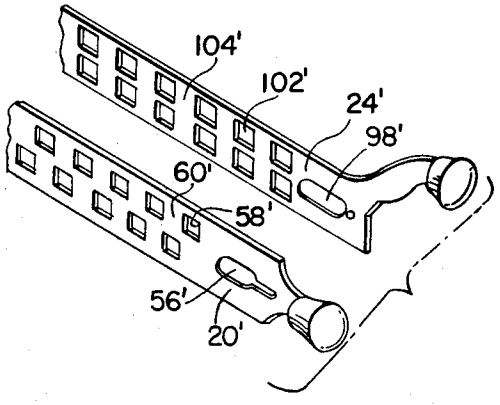

FIG. 9.

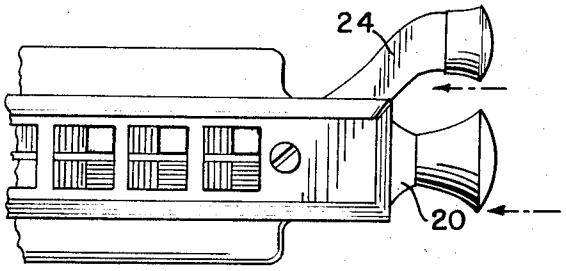

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FIG. 14.

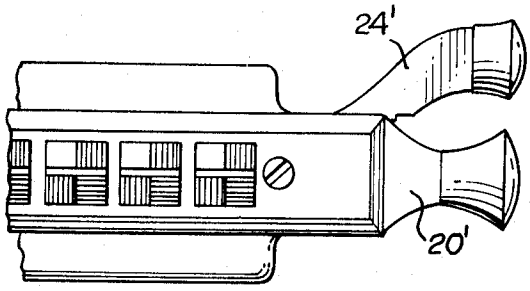


FIG. 15.

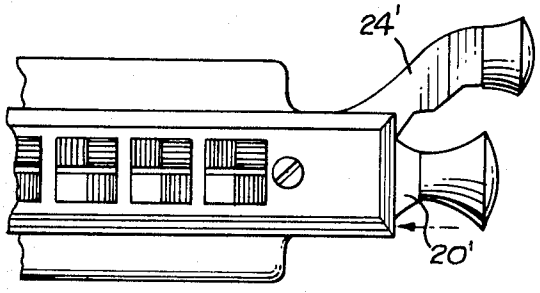
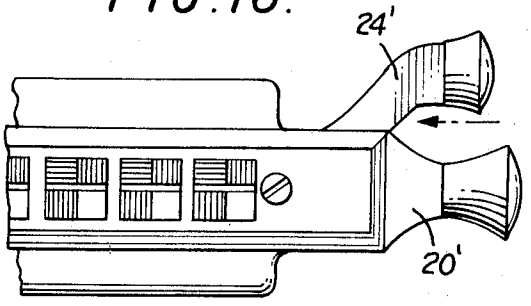


FIG. 16.



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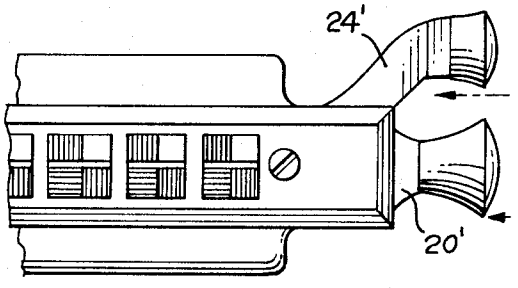
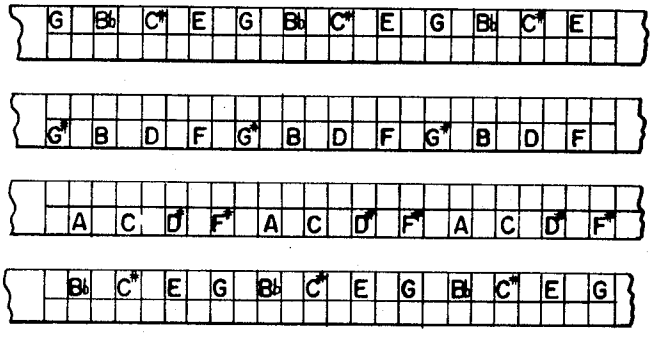


FIG. 18.



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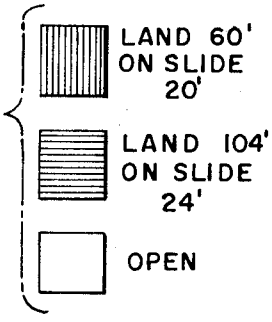

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FIG. 19.

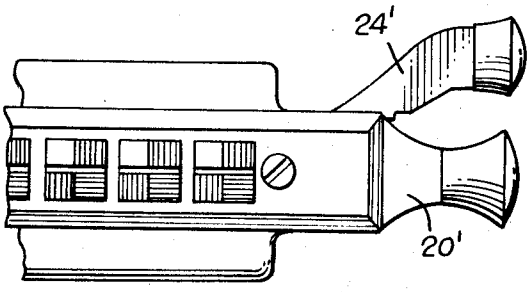
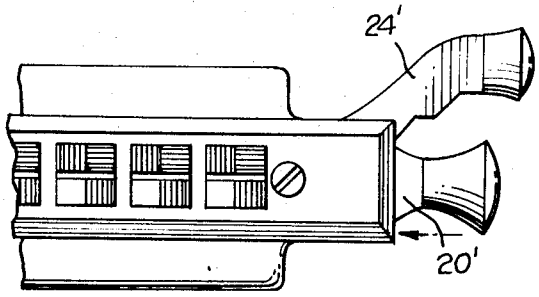


FIG. 20.



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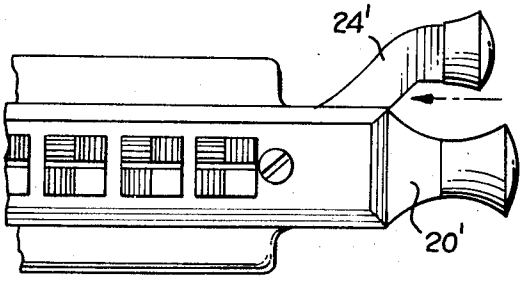


FIG. 22.

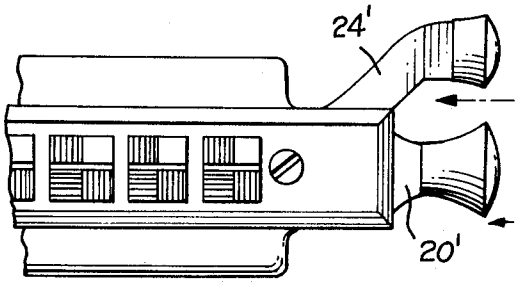
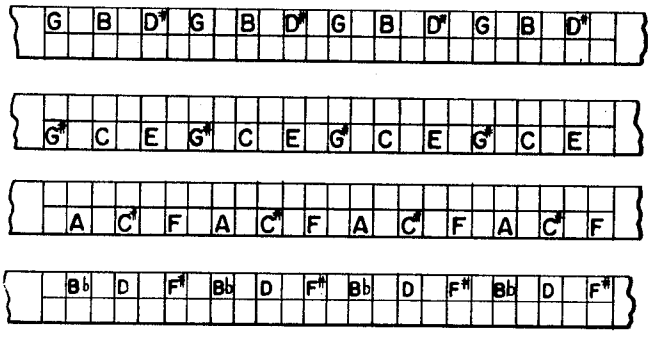


FIG. 23



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CHROMATIC HARMONICA

BACKGROUND OF THE INVENTION

1. Field of the Invention

The instant invention relates generally to harmonicas, mouth organs and similar wind instruments utilizing multiple tuned vibrating reeds for producing musical notes, and more particularly, to improvements in the structural configuration and operational characteristics of such instruments by the provision therein of a pair of independently movable valve slides that control the unidirectional flow of air through the instrument.

2. Description of the Prior Art

Harmonicas, mouth organs and similar multiple reed wind instruments of conventional design are played by controlling the pattern of inhalation and exhalation of one's breath through a series of openings in the mouthpiece of the instrument. These openings, in turn, communicate with a comb divided into a cellular configuration by a unitary lateral partition and a plurality of closely spaced longitudinal walls. A plurality of tuned, vibratable reeds are positioned in operative relationship for producing musical tones as the breath, or air, passes through the casing and exits or enters at the rear thereof.

A note produced in response to the inhalation of breath is designated as a draw note, and a note produced in response to the exhalation of breath is designated as a blow note. Accordingly, most known harmonicas are played in a blow and draw fashion. The more versatile chromatic harmonica is distinguished from its diatonic counterpart by the provision of a manually operable perforated valve slide that selectively covers, or uncovers, the particular reeds tuned to the scale of C $^{\#}$, thus providing all notes of the 12 tone chromatic scale. The manipulation of the perforated valve slide must be coordinated with the pattern of blow and draw operations for satisfactory results.

Representative chromatic harmonicas employing such perforated valve slides are disclosed in U.S. Pat. No. 2,179,993, granted to Davies, and U.S. Pat. Nos. 2,339,790 and 2,384,758, both granted to Magnus. However, these patented structures, as well as the other harmonica configurations which rely upon the blow and draw technique and are currently available through commercial channels, are inherently subject to numerous structural and operational shortcomings by virtue of this reliance upon the blow and draw technique.

For example, it is difficult to perform a smooth transition from a blow note to a draw note, and vice versa, because of the reversal of the player's breath flow from exhalation to inhalation. The transition from one blow note to another blow note, or from one draw note to another draw note, is easier to perform in a smooth manner for the player's breath flow is unidirectional. Consequently, with conventional harmonicas, some transitions are smoother than others and inconsistencies in producing the same note adversely affect the quality of a performance.

Flap valves have frequently been employed on chromatic harmonicas as a wind or breath saving device. However, these valves eventually wear out and must be replaced, thus causing inconvenience and expense. Furthermore, such valves occasionally vibrate in sympathy with the reeds within the casing, thus creating undesirable buzzing sounds. Lastly, the rapid reversal, or bidirectional flow through the instrument, of one's breathing pattern necessitated by a sequence of blow and draw notes has adversely affected the clarity, flexibility and uniformity of tonal quality of known harmonicas.

U.S. Pat. No. 2,459,184, granted to Ruffino, sets forth one proposed harmonica configuration for eliminating the need for valves. Such harmonica employs a comb divided by a unitary lateral partition and a series of vertically extending walls into a cellular configuration, with a first set of cells located below the partition and a corresponding second set of cells located above the partition. A pair of blow reeds are disposed within each cell of the upper set of cells, and a pair of draw reeds are disposed within each cell of the lower set of cells.

Each opening in the mouthpiece is large enough to communicate with a pair of cells of the upper set and a corresponding pair of cells of the lower set. Thus, the harmonica is so arranged that four air passages with four individual reeds share a common mouth opening.

In order to isolate, or render ineffective, three of the four reeds operatively associated with each opening in the mouthpiece, a pair of control valves are employed in the Ruffino harmonica. The first control valve assumes the form of a perforated valve slide, such slide being laterally shiftable to cover either of the vertical pair of cells communicating with each opening in the mouthpiece. The second control valve assumes the form of a pivotable valve shaft with a series of plastic flap valves secured thereon. The flap valves, which are disposed between the mouthpiece and the cellular comb, oscillate between a pair of seats to close off either the lower cell or the upper cell within the pair of vertically aligned cells selected by the manipulation of the perforated valve slide. Consequently, air or breath is blown through such harmonica when the oscillating valve is in one position, and air or breath is drawn through such harmonica in the reverse direction when the oscillating valve is in its other position.

Although the use of the oscillatable flap valve in conjunction with the well known perforated control lever in a blow and draw chromatic harmonica may well have minimized a few of the numerous shortcomings of these instruments detailed above, many of the basic inherent defects remain uncorrected at the present time. These defects have reduced the feasibility of a simplified low-cost and efficient chromatic harmonica that is easy to manufacture and yet can produce sounds of excellent tonal quality.

SUMMARY

Thus, with the deficiencies of the prior art harmonicas enumerated above in mind, the preferred embodiment of the instant invention contemplates an efficient chromatic harmonica comprising components of relatively simple design that enables an all-blow or all-draw mode of operation. This primary objective of unidirectional flow through the casing at all times is achieved in the instant invention by providing a unique second perforated slide having a pattern of lands and apertures that cooperate with the pattern of lands and apertures found in the conventional first perforated slide which controls the semi-tones of the chromatic scale. The two slides, which are independently movable, are operatively disposed between the openings in the mouthpiece and the plurality of tuned reeds within the casing located in registry with the comb. Such comb is divided by a lateral partition and a series of closely spaced vertical walls into an upper set of wind cells and a lower set of wind cells. A blow reed is disposed in each wind cell, and each opening in the mouthpiece communicates with a pair of upper wind cells and a pair of lower wind cells. By proper manipulation of the pair of independently movable perforated slides, three of the four wind cells associated with each opening are completely covered by the lands in the slides and only the selected fourth wind cell and the blow reed disposed in operative relation thereto can be actuated by expelling one's breath. To insure proper alignment and movement of the perforated slides, each slide is spring loaded to a home position and moves laterally between a pair of interlocking guides.

In an alternative embodiment, the orientation of the reed plates is reversed, and one's breath is inhaled, rather than expelled, thus producing an all-draw harmonica.

In both the preferred and alternative embodiments of the instant harmonica, the construction of the reed plate assemblies is simplified for the reeds are mounted on only one surface of each reed plate, e.g., the bottom surface of the top plate and the top surface of the bottom plate in the all-blow embodiment.

Furthermore, more trills are available with the instant harmonica than are possible with conventional, slide-type chromatic harmonicas.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a chromatic harmonica constructed in accordance with the principles of the instant invention.

FIG. 2 is an exploded perspective view of the mouthpiece, the perforated slides, the guides for said slides, and the comb employed within the instant invention.

FIG. 3 is a vertical cross-sectional view of the harmonica depicting, inter alia, the relationship of a wind cell to a tuned reed operatively associated therewith, such view being taken along line 3—3 of FIG. 1 and in the direction indicated.

FIG. 4 is a top plan view of the harmonica and the movable slides, a central section of the body of the harmonica having been removed therefrom.

FIG. 5 is a diagrammatic representation of one note arrangement that can be played by the manipulation of the two movable slides of FIG. 2 into one of four operative positions.

FIG. 6 is a front elevational view of the right hand corner of the harmonica showing both of the slides in their unactuated, home position.

FIG. 7 is a view identical to FIG. 6, but the slide closest to the viewer has been shifted laterally into the actuated position.

FIG. 8 is a view identical to FIG. 6, but the slide furthest from the viewer has been shifted laterally into its actuated position.

FIG. 9 is a view identical to FIG. 6, but both slides have been shifted laterally into the actuated position.

FIG. 10 is a legend for correlating the movement of the slides depicted in FIGS. 6–9.

FIG. 11 is a front elevational view of the left hand corner of an alternative embodiment of the harmonica, such view showing diagrammatically the notes operatively associated with each opening in the mouthpiece.

FIG. 12 is an exploded, partial perspective of a pair of perforated slides employed with an alternative embodiment of the instant invention.

FIG. 13 is a legend for correlating the movement of the slides depicted in FIG. 12.

FIG. 14 is a front elevational view of the right hand corner of the harmonica showing both of the slides of FIG. 12 in their unactuated, home position.

FIG. 15 is a view identical to FIG. 14, but the slide closest to the viewer has been shifted laterally into the actuated position.

FIG. 16 is a view identical to FIG. 14, but the slide furthest from the viewer has been shifted laterally into its actuated position.

FIG. 17 is a view identical to FIG. 14, but both slides have been shifted laterally into the actuated position.

FIG. 18 is a diagrammatic representation of one note arrangement that can be played by the manipulation of the two movable slides of FIG. 12 into one of four operative positions.

FIG. 19 is a front elevational view of the right hand corner of the harmonica showing an alternative configuration of the slides of FIG. 12 in their unactuated, home position.

FIG. 20 is a view identical to FIG. 19, but the slide closest to the viewer has been shifted laterally into the actuated position.

FIG. 21 is a view identical to FIG. 19 but the slide furthest from the viewer has been shifted laterally into the actuated position.

FIG. 22 is a view identical to FIG. 19 but both slides have been shifted laterally into the actuated position; and

FIG. 23 is a diagrammatic representation of another note arrangement that can be played by the manipulation of the two movable slides of FIG. 12 into one of four operative positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in greater detail to the drawings in which similar reference numerals refer to similar components, FIG. 1 depicts an all-blow harmonica with a mouthpiece **10** having a series of 12 horizontally aligned rectangular openings of equal dimensions formed therein, such openings being designated **12***a* – **12***l*. The mouthpiece is secured to the substantially rectangular body of the harmonica, indicated generally by reference numeral **14**, by screws **16** located in threaded holes **18** located adjacent to opposite ends of the mouthpiece. A short length of plastic tubing **17** may be slipped over the screws.

A first slide **20**, having a knob **22** at its right end, extends laterally across the width of the harmonica body **14** and is disposed close to mouthpiece **10**. A second slide **24**, having a knob **26** at its upwardly extending right end also extends laterally across the width of the harmonica body. Slide **24** is disposed behind slide **20** and in front of the harmonica body; phrased in another manner, slide **24** is further away from mouthpiece **10** than slide **20**.

A curved metallic u-per cover **28** with an upstruck rear lip **29** overlies the upper surface of body **14** and has flanges **30** and **32** at its opposite ends for securement purposes. An upper reed plate **34** and a lower reed plate **36** (shown in FIG. 3), which are equal in size and shape to the upper and lower surfaces of body **14**, are joined thereto. Bolts **38** and **40** pass through flanges **30** and **32** of upper cover **28** and through reed plate **34** to thereby retain these members in place upon body **14**. The lower reed plate **36** and the lower cover member, not visible in FIG. 1, are secured to the underside of body **14** by the same bolts.

Turning now to FIG. 2, it is noted that the upper and lower covers and the corresponding reed plates **34** and **36** have been omitted from this view and that the remainder of the components of the instant chromatic harmonica are shown in an exploded perspective for the sake of clarity. The components are examined in sequence from front to back, thus defining the path of the flow of air or breath utilized in playing this instrument in an all-blow mode.

Mouthpiece **10** has a tapered upper surface and a tapered lower surface, which facilitates positioning of the harmonica within the mouth of the player. Openings **12***a*–**12***l* have slanted surfaces which taper inwardly to facilitate the passage of air or breath into the interior of the harmonica.

A first guide **42** is located behind mouthpiece **10** and in front of slide **20**. Guide **42** has a slot **44** at its right hand end, and a matching slot **46** at its left hand end. These slots have a narrow entranceway and an enlarged circular inner terminal portion, which enable screws **16** to pass therethrough and secure guide **42** in fixed relation to body **14**.

The lateral extent of guide **42** is divided into 24 rectangular apertures **48**, the lower series of apertures being identified as **48***a*–**48**, respectively, and the upper series of apertures being identified as **48***m*–**48***x*, respectively. The size and orientation of apertures **48** is such that apertures **48***a* and **48***m* in the slide are always exposed to opening **12***a* in mouthpiece **10**, and openings **48***l* and **48***x* are always exposed to opening **121**. Similar relationships are established along the length of the mouthpiece.

Guide **42** has an upper lip **50**, which extends rearwardly for a distance greater than the thickness of slide **20**. Tangs **52**, **53** and **54** are formed on the lip for securement and alignment purposes, for reasons that will become apparent at a later point in this description.

The first perforated slide **20** is located behind guide **42**, and such slide has slots **56** and **57** at its opposite ends. These slots enable screws **16** to pass therethrough and secure the slide to the body **14** of the harmonica. In contradistinction to the circular slots in the fixed guide **42**, however, the length of slots **56**, **57** is sufficient to permit lateral movement of the slide relative to guide **42** and body **14**.

Slide **20** also has a pattern of 13 vertically aligned apertures **58** with lands **60** spaced therebetween. The lower set of apertures is identified as **58***a*–**58***m*, and the upper set of 13 apertures is identified as **58***n*–**58***z*. Apertures **58** are selected to be of a size equal to one-half of the width of aperture **48** in guide **42** and substantially one-half of the width of openings **12** in mouthpiece **10**. Stated in another manner, the combined width of each aperture **58** and its adjacent land **60** is substantially equal in size to each opening **12** in mouthpiece **10**. Ac-

cordingly, by exerting manual pressure on knob **22** of slide **20** to shift same laterally, lands **60** selectively isolate either the right half or the left half of the air passages formed between mouthpiece **10** and the reed plates secured to body **14** of the harmonica.

Continuing rearwardly toward body **14**, guide **62** has notches **64**, **65** and **66** adjacent its opposite ends and at its midpoint to receive therein tangs **52**, **53** and **54** of previously described guide **42**. A second set of tangs are formed on the rearwardly extending lower lip (not shown) of guide **42** and are received in notches **68**, **69** and **70** in the lower surface of guide **62**. By virtue of these interlocking tangs, guides **42** and **62** are secured together to form a sheath for perforated slide **20**, frequently referred to as the accidental slide. The resultant sheath maintains the accidental slide **20** in proper alignment at all times.

Guide **62** gas a slot **72** at its right hand end and a matching slot **74** at its left hand end. Both slots have a narrow entranceway and an enlarged inner circular terminal protion, which enables screws **16** to pass therethrough and secure guide **62** in fixed relation to body **14**.

The lateral extent of guide **62** is divided into 48 rectangular apertures, the lower series of 24 apertures being identified as **76***a*–**76**, respectively, and the upper series of 24 apertures being identified as **78***a*–**78***x*, respectively. The size and orientation of apertures **76** and **78** in the slide is such that apertures **76***a*, **76***b* and **78***a*, **78***b* are aligned with opening **12***a* in mouthpiece **10**. Similarly, apertures **76***w*, **76***x* and **78***w*, **78***x* are aligned with opening **121** in mouthpiece **10**. Since slide **20** can be moved laterally within the sheath formed by guides **42** and **62**, the pattern of lands **60** and apertures **58** selectively interrupt the flow of breath through the harmonica.

For example, if slide **20** is normally biased toward the right by spring means disposed within body **14**, then the vertical extent of lands **60** will rest in front of apertures **76***b* and **78***b* that are in the flow path for opening **12***a* in the harmonica; however, flow through apertures **76***a* and **78***a* is uninterrupted. If slide **20** is shifted laterally to the left by exerting manual pressure on knob **22** with the second finger of the right hand, then lands **60** will move in front of openings **76***a* and **78***a* and block same; however, flow through openings **76***b* and **78***b* is uninterrupted. The same pattern of alternate blocking and unblocking of openings is repeated along the length of guide **62**.

Referring again to FIG. **2** and continuing rearwardly toward body **14**, a third guide **80** is located behind guide **62** of the first sheath and in front of the second slide **24**. Guide **80** has a slot **82** at its right hand end, and a matching slot **84** at its left hand end. Both slots have a narrow entranceway and an enlarged circular inner terminal portion which enables screws **16** to pass therethrough and secure guide **80** in fixed relation to body **14**.

The lateral extent of guide **80** is divided into 48 rectangular apertures, the lower series of apertures being identified as **86***a*–**86** and the upper series of apertures being identified as **88***a*–**88**, respectively. The size and orientation of apertures **86** and **88** is identical to the apertures **76** and **78** in guide **62**; thus, the movement of slide **20** with its pattern of apertures **58** and lands **60** alternately covers, and uncovers, each vertical pair of apertures in guide **80**.

Guide **80** has an upper lip **90** which extends rearwardly for a distance greater than the thickness of slide **24**. Tangs **92**, **94** and **96** are formed along the lip for securement and alignment purposes, in much the same manner as tangs **52**, **53** and **53** functioned in the previously described sheath for slide **20**.

The second perforated slide **24** is located behind guide **80** and has slots **98** and **100** at its opposite ends to enable screws **16** to pass therethrough and secure the slide to body **14** of the harmonica. In contradistinction to fixed guides **42**, **62** and **80**, however, the length of the slots is sufficient to permit lateral movement of slide **24** relative to the guides and body **14**.

Slide **24** has a pattern of vertically spaced, laterally offset apertures **102** with alternating lands **104** disposed therebetween. The lower set of 12 apertures is identified as **102***a*–**102***l*, and the upper set of 13 apertures is identified as **102***m*–**102***y*. Apertures **102** are selected to be of a size equal to one-half of the width of apertures **48** in guide **42**. Stated in another manner, the combined width of each aperture **102** and its adjacent land **104** is equal in size to each aperture **48** in guide **42**. Accordingly, by exerting manual pressure on knob **26** of slide **24** with the third finger of the right hand to shift same laterally, lands **104** selectively isolate either the upper left and lower right quadrant or the lower left and upper right quadrant of the air passages formed between mouthpiece **10** and the reed plates operatively mounted upon body **14** of the harmonica. Manifestly, by proper manipulation of independently movable perforated slides **20** and **24**, each air passage has three of its four quadrants blocked or isolated at all times, and only the reed aligned with uninterrupted quadrant of each air passage can be played by expelling or blowing air.

The fourth, and last, guide **106** has a set of three notches **107**, **109** and **111** formed in its upper surface to receive therein tangs **92**, **94** and **96** of the third guide **80**. A similar set of tangs are formed on the rearwardly extending lower lip (not shown) of guide **80** and are received in a set of three notches **113**, **115** and **117** in the lower surface of guide **106**. By virtue of these interlocking tangs, guides **80** and **106** are secured together to form a sheath for perforated slide **24**, which is designated as an auxiliary slide to distinguish same from the semi-tone or accidental slide **20**. This sheath maintains slide **24** in proper alignment at all times.

Guide **106** has a slot **112** at its right hand end and a matching slot **114** at its left hand end. The slots are shaped to enable screws **16** to pass therethrough and secure guide **106** in fixed relation to body **14**.

The lateral extent of guide **106** is divided into 48 rectangular apertures, the lower series of 24 apertures being identified as **116***a*–**116***x* and the upper series of 24 apertures being identified as **118***a*–**118***x*, respectively. The size and orientation of apertures **116** and **118** are identical to apertures **86** and **88** in guide **80**. Since slide **24** can be moved laterally within the sheath formed by guides **80** and **106**, the pattern of lands **104** serves to interrupt the flow of breath through the harmonica.

Since slide **24** is normally biased toward the right by a cantilever spring, best seen in FIG. **4**, the vertical extent of lands **104** will rest in front of apertures **86***a* and **88***b* that are in the flow path for opening **12***a* in the harmonica; however, flow through apertures **86***b* and **88***a* is uninterrupted. If slide **24** is shifted laterally to the left, then lands **104** will move in front of apertures **86***b* and **88***a* to block same; however, flow through apertures **86***a* and **88***b* is uninterrupted. The same pattern of alternate blocking and unblocking of apertures is repeated along the length of guide **80**. Manifestly, by the proper manipulation of independently movable slides **20** and **24**, three of the four quadrants of the potential flow path associated with the openings **12** in the mouthpiece **10** are blocked by the coacting lands on the slides; consequently, only one quadrant of the potential flow path is uninterrupted and is thus responsive to the blow operation at any time.

The front of the body **14** of the harmonica is located immediately behind rearmost guide **106**. Body **14** is divided into 48 individual wind cells by a single horizontal partition and a plurality of closely-spaced vertical walls, and the cross-sectional area of the entrance portion of each wind cell is substantially equal to the area of the apertures in slides **20** and **24**. Each of the resultant wind cells communicates with its own tuned vibratable reed secured to plates **34** or **36**. The lower series of wind cells is designated **120***a*–**120***x*, and the upper series of wind cells is designated **122***a*–**122***x*. The cross-sectional area of the entrance portion of each wind cell is identical to the area of the apertures in guides **62**, **80** and **106**, and approximately one-fourth the area of each opening **12** in mouthpiece **10**. The surfaces within body **14**, which surfaces define the length of the cell, are longest at the left side of the body and gradually diminish toward the right side of the body.

However, since the flow path between each opening in the mouthpiece and its four aligned wind cells is always blocked in

three quadrants by the overlapping lands **60** and **104** on independently movable slides **20** and **24**, respectively, only one wind cell at a time and its reed can establish communication with the mouthpiece to be operated therefrom.

A hole **119** is drilled adjacent each end of body **14** to receive screws **16** and thus securely fasten the mouthpiece, sheaths, and slides to the face of the harmonica. Disposed adjacent to holes **119** are cantilever springs **124** and **126**, which extend through the slots at the right and left hand of the above noted members. Spring **126**, which is slightly longer than spring **124**, biases the accidental slide **20** to the right, and spring **124** biases the auxiliary slide **24** to the right.

FIG. **3** is a vertical cross-sectional view of the chromatic harmonica construction showing, on an enlarged scale, the actual spatial relationships followed when the harmonica is assembled. Viewing the components from left to right, one sees the tapered mouthpiece **10**, guide **42**, perforated slide **20**, guide **62**, guide **80**, second perforated slide **24**, and guide **106**. The sheath formed by guides **42** and **62** for perforated slide **20** is apparent, as is the sheath formed by guides **80** and **106** for perforated slide **24**.

Tuned reeds **34***a*–**34***x* are riveted at one end to reed plate **34** and are disposed atop the upper wind cells **122***a*–**122***x*, while tuned reeds **36***a*–**36***x* are riveted to reed plate **36** and are disposed beneath the lower wind cells **120***a*–**122***x*. Each reed is operatively associated with a wind cell. The harmonica assembly is completed by a lower curved cover **128** with a rear lip **129**.

The reference character **130** calls attention to a possible flow path through opening **12***f* of the harmonica when a land **104** on slide **24** isolates the mouthpiece **10** from lower wind cell **120***k*. Consequently, the breath of air expelled into opening **12***f* in the mouthpiece will flow directly into wind cell **122***k* in body **14**, and then escape past reed **34***k*, enter the pocket defined between cover **28** and plate **34**, and thence pass into the atmosphere. The rush of air past the tuned reed will cause it to vibrate at the selected frequency and produce the desired musical tone.

FIG. **4** more clearly shows the interrelationship of cantilever springs **124** and **126**. These springs have one end wrapped about a vertical post located within body **14** of the harmonica, and the free ends thereof fit into slots at opposite sides of the four guides and two perforated slides. Additionally, the extent of lateral movement for slides **20** and **24** is indicated by appropriate two headed arrows.

FIG. **5** is a four-step schematic or diagrammatic development of the sequence in which the 12 notes on the chromatic scale can be played in an all-blow mode by proper manipulation of perforated slides **20** and **24**. The four step sequence is correlated with the four positions of the two slides, as illustrated by FIGS. **6–9**. Mouthpiece opening **12***k* is chosen as a representative opening for discussing the operation of the instant harmonica.

Let us assume that the three rightmost blocks in FIG. **5** correspond to openings **12***j*, **12***k* and **12***l* in mouthpiece **10**, and that four wind cells are available for communication with each opening in the mouthpiece. Also, with respect to FIGS. **6–9**, the lands **60** that are shifted by lateral movement of perforated slide **20** are indicated by vertical striping; the lands **104** that are shifted by lateral movement of perforated slide **24** are indicated by horizontal striping. The legend of FIG. **10** further explains this relationship.

Now, with respect to opening **12***k* if one wishes to play the note G through opening **12***k* in the mouthpiece, he merely blows therethrough without moving either slide **20** or slide **24**. The pattern of lands **60** and **104** on the slides isolates three of the four wind cells and directs the breath through the wind cell located in alignment with the upper left hand quadrant of opening **12***k*. This position is schematically shown by the first line of FIG. **5** and the corresponding slide position seen in FIG. **6**.

Now, if one wishes to produce the note G # through opening **12***k*, he merely blows therethrough after moving accidental slide **20** with lands **60** toward the left against its biasing spring. Auxiliary slide **24** with lands **104** remains in its home position. The lands **60** and **104** cooperate to isolate three of the four wind cells and direct the breath through the wind cell located in alignment with the lower right hand quadrant of opening **12***k*. This position is shown schematically by the second line of FIG. **5** and the corresponding slide position is seen in FIG. **7**; note the directional arrow adjacent slide **20**.

Now, if one wishes to produce the note A through opening **12***k*, he merely blows therethrough after moving auxiliary slide **24** with lands **104** toward the left against its biasing spring. Accidental slide **20** with lands **60** remains in its home position. The lands **60** and **104** cooperate to isolate three of the four wind cells and direct the breath through the wind cell located in alignment with the lower left hand quadrant of opening **12***k*. This position is shown schematically by the third line of FIG. **5** and the corresponding slide position is seen in FIG. **8**; note the directional arrow adjacent slide **24**.

Lastly, if one wishes to produce the note A # through opening **12***k*, he merely blows therethrough after moving both accidental slide **20** and auxiliary slide **24** to the left against their biasing springs. Once again, the lands **60** and **104** cooperate to isolate three of the four wind cells and direct the breath through the wind cell located in alignment with the upper right hand quadrant of opening **12***k*. This position is shown schematically by the fourth line of FIG. **5** and the corresponding slide position is seen in FIG. **9**; note the directional arrows adjacent slides **20** and **24**.

FIG. **11** is a schematic view of an alternative embodiment of the instant chromatic harmonica and FIG. **12** illustrates the pattern of apertures and lands that would be employed. Accidental slide **20** has laterally offset and vertically spaced apertures **58′** with intervening lands **60′**. Auxiliary slide **24′** has vertically aligned apertures **102′** and land **104′**. Once again by proper manipulation of the pair of independently movable slides three of the four wind cells operatively associated with each opening in the mouthpiece of the harmonica are isolated and a single tuned reed is actuated.

The preferred embodiment of FIGS. **1–10** is played in all-blow mode. Either embodiment could be played in an all-draw mode if the tuned reeds were all placed on opposite sides of the top and bottom plates, an easily effectuated reversal of parts.

The transition from the preferred embodiment to the alternative embodiment, regardless of whether the harmonica is played in an all-draw or all-blow fashion, is achieved by rearranging some of the reeds and interchanging the location of the slides with one another. The function of these two slides is similarly interchanged. The resultant accidental slide (the auxiliary slide in the preferred embodiment) is identified by the reference numeral **20′** in FIG. **12** and the resultant auxiliary slide (the accidental slide in the preferred embodiment) is identified by the reference numeral **24′**. As noted previously, the preferred embodiment and the alternative embodiment can be played in the same mode, be it all-draw or all-blow.

FIG. **13** is a legend for correlating the movement of slides **20′** and **24′** of FIG. **12** in the same manner as FIG. **10** clarifies the movement of slides **20** and **24** for the preferred embodiment seen in FIGS. **6–9**. FIGS. **14–17** illustrate that by proper manipulation of independent slides **20′** and **24′**, three of the four wind cells operatively associated with each opening in the mouthpiece of the harmonica are isolated and a single tuned reed is actuated. The slide, or slides, being actuated is indicated by appropriate directional arrows. FIG. **18** shows one note arrangement that can be achieved by the manipulation of slides **20′** and **24′**.

FIGS. **19–23**, which correspond to FIGS. **14–18**, show the manner in which another note arrangement can be achieved by the manipulation of slides **20′** and **24′**.

Since still additional alternative embodiments employing the same basic unidirectional flow principles may be made without departing from the scope of the instant invention, it is

to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative in nature and not in a limiting sense.

I claim:

1. A harmonica comprising:
a. a casing,
b. a comb having a plurality of individual cells formed therein,
c. a plurality of tuned, vibratable reeds disposed within said casing, each reed being situated in operative relationship to one of said cells in said comb,
d. a mouthpiece having a series of openings formed therein, each opening being in alignment with a plurality of cells for communication therebetween,
e. first manually operable valve means disposed between said mouthpiece and said comb, said first valve means including a first perforated valve slide having a first pattern of lands and apertures therein to prevent communication between a first set of said plurality of cells and the aligned openings in said mouthpiece,
f. said first valve means further including a pair of perforated guides, said guides being disposed on opposite sides of said perforated slide to form a sheath therefor,
g. the pattern of said first perforated valve slide comprising a pair of vertically spaced aligned apertures and a land extending vertically for the entire height of said slide, each individual aperture of said pair of aligned apertures in said first slide being substantially equal in width and height to the dimensions of said perforations in one perforated guide of the pair of guides and substantially half the width of the perforations in the other perforated guide,
h. said first valve means being mounted within its sheath for independent movement relative to said mouthpiece,
i. second manually operable valve means disposed between said first valve means and said comb, said second valve means including a second perforated valve slide having a second, distinctively different pattern of lands and apertures formed therein to prevent communication between a second set of said plurality of cells and the aligned openings in said mouthpiece,
j. said second valve means further including a pair of perforated guides, said guides being disposed on opposite sides of said perforated slide to form a sheath therefor,
k. said second valve means being mounted within its sheath for independent movement relative to said mouthpiece and to said first valve means so that the first and second pattern of lands and apertures on said valve slides cooperate with each other whereby the harmonica can be played in a unidirectional mode.

2. The harmonica as defined in claim 1 wherein said comb is divided by a horizontal partition and a plurality of vertical walls into an upper and a lower series of wind cells, each opening in said mouthpiece being aligned with four wind cells.

3. The harmonica as defined in claim 1 wherein the pattern of said second perforated valve slide comprises an upper series of apertures and a lower series of apertures, said upper series being laterally offset from said lower series of apertures, and each of said apertures being substantially the same height and width as the perforations in said first and second perforated guides.

4. The harmonica as defined in claim 1 wherein said first and second valve means are normally biased into a home position by cantilever spring means, said spring means being disposed within opposite ends of said comb so that the free end of each of said spring means protrude beyond said comb.

5. The harmonica as defined in claim 1 wherein each pair of perforated guides is joined by interlocking means.

6. A harmonica comprising:
a. a casing,
b. a comb having a plurality of individual cells formed therein,
c. a plurality of tuned, vibratable reeds disposed within said casing, each reed being situated in operative relationship to one of said cells in said comb,
d. a mouthpiece having a series of openings formed therein, each opening being in alignment with a plurality of cells for communication therebetween,
e. first manually operable valve means disposed between said mouthpiece and said comb, said first valve means including a first perforated valve slide having a first pattern of lands and apertures therein to prevent communication between a first set of said plurality of cells and the aligned openings in said mouthpiece,
f. said first valve means further including a pair of perforated guides, said guides being disposed on opposite sides of said perforated slide to form a sheath therefor,
g. the pattern of said first perforated valve slide comprising an upper series of apertures and a lower series of apertures, said upper series being laterally offset from said of series 'f apertures, each of said apertures being substantially equal in height to the perforations in said pair of perforated guides and substantially half the width of the perforations in one of said pair of perforated guides,
h. said first valve means being mounted within its sheath for independent movement relative to said mouthpiece,
i. second manually operable valve means disposed between said first valve means and said comb, said second valve means including a second perforated valve slide having a second, distinctively different pattern of lands and apertures formed therein to prevent communication between a second set of said plurality of cells and the aligned openings in said mouthpiece,
j. said second valve means further including a pair of perforated guides, said guides being disposed on opposite sides of said perforated slide to form a sheath therefor,
k. said second valve means being mounted within its sheath for independent movement relative to said mouthpiece and to said first valve means so that the first and second pattern of lands and apertures on said valve slides cooperate with each other whereby the harmonica can be played in a unidirectional mode.

7. The harmonica as defined in claim 6 wherein the pattern of said second perforated valve slide comprises a pair of vertically spaced aligned apertures and a land extending vertically for the height of said valve slide.

8. The harmonica as defined in claim 6 wherein said comb is divided by a horizontal partition and a plurality of vertical walls into an upper and lower series of wind cells, each opening in said mouthpiece being aligned with four wind cells.

9. The harmonica as defined in claim 6 wherein said first and second perforated slides are normally biased into a home position by cantilever spring means, said spring means being disposed within opposite ends of said comb so that the free end of each of said spring means protrudes beyond said comb.

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