United States Patent

Heiman

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[54] MECHANICALLY BALANCED KEYBOARD AND REED CHAMBER ASSEMBLY FOR MUSICAL INSTRUMENTS

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[22] Filed: **Sept. 18, 1970**

[21] Appl. No.: **73,332**

[52] **U.S. Cl.**.....**84/351,** 84/423, 84/438

[51] **Int. Cl.**.....**G10b 1/08,** G10c 3/12

[58] **Field of Search**.....84/351, 360, 363, 365, 375, 84/376, 423, 433, 435, 438

[56] **References Cited**

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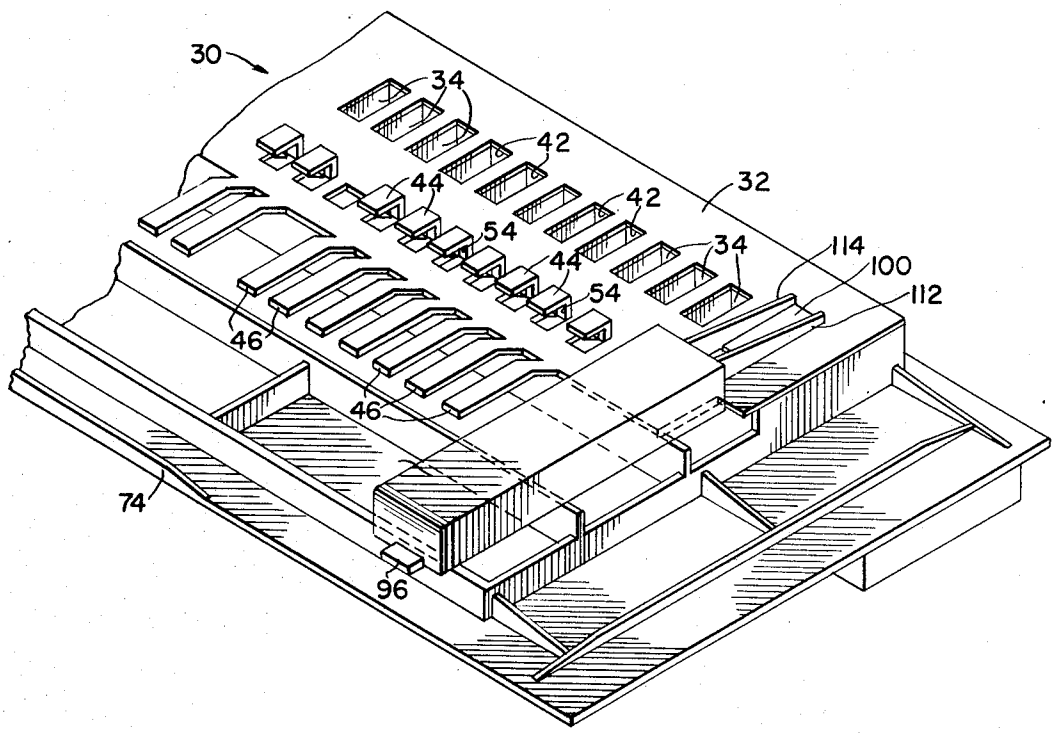
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Assistant Examiner—John F. Gonzales
Attorney—Schellin and Hoffman

[57] **ABSTRACT**

An air-operated musical instrument utilizing a unique keyboard and reed chamber assembly fabricated from relatively few, readily molded plastic components. The keyboard and reed chamber assembly are designed so that the keyboard, when secured to the reed chamber, is in mechanical balance or in equilibrium, therewith. Each key in the keyboard includes a forwardly extending finger pad, a rearwardly extending key stop, an intermediate pivot bar, a locking notch and an alignment notch. The reed chamber assembly includes a reed plate having a plurality of tuned reeds, a like plurality of resonance chambers having a port at the upper end of each chamber, a plurality of pivot posts, and a plurality of forwardly extending anchored springs. Each key is individually joined to the reed chamber assembly by snapping the pivot bar into locking engagement with a pivot post. The key stop then seals the port of the resonance chamber to block the passage of air therethrough. Depression of the finger pad of the selected key causes the key to pivot about the pivot bar and permits the passage of air through the selected resonance chamber, thus producing a musical tone.

17 Claims, 11 Drawing Figures



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FIG. 1.

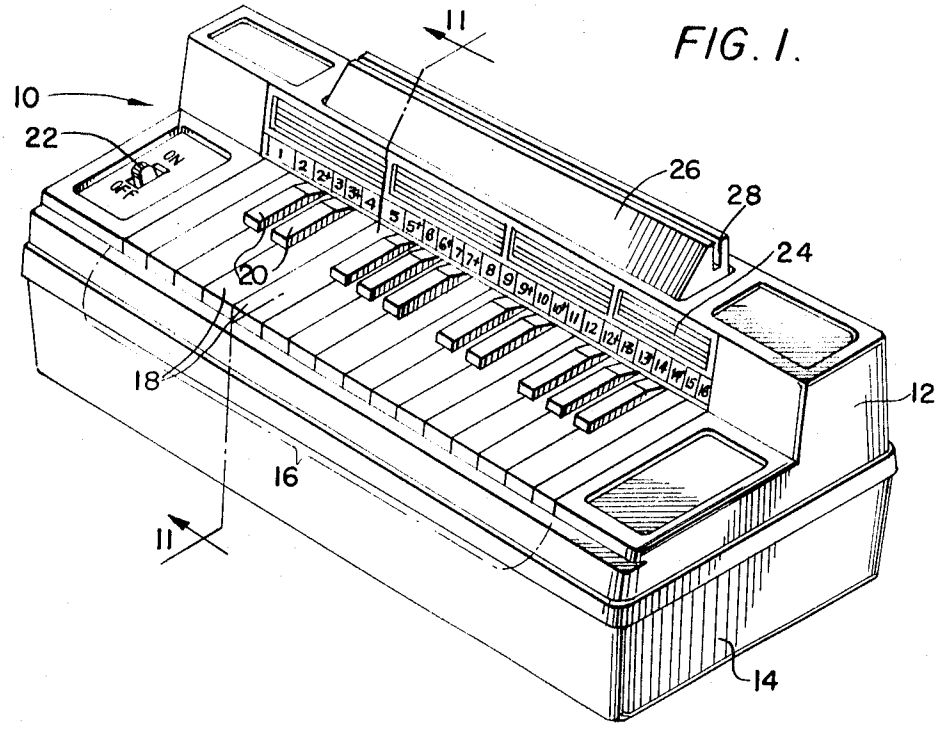
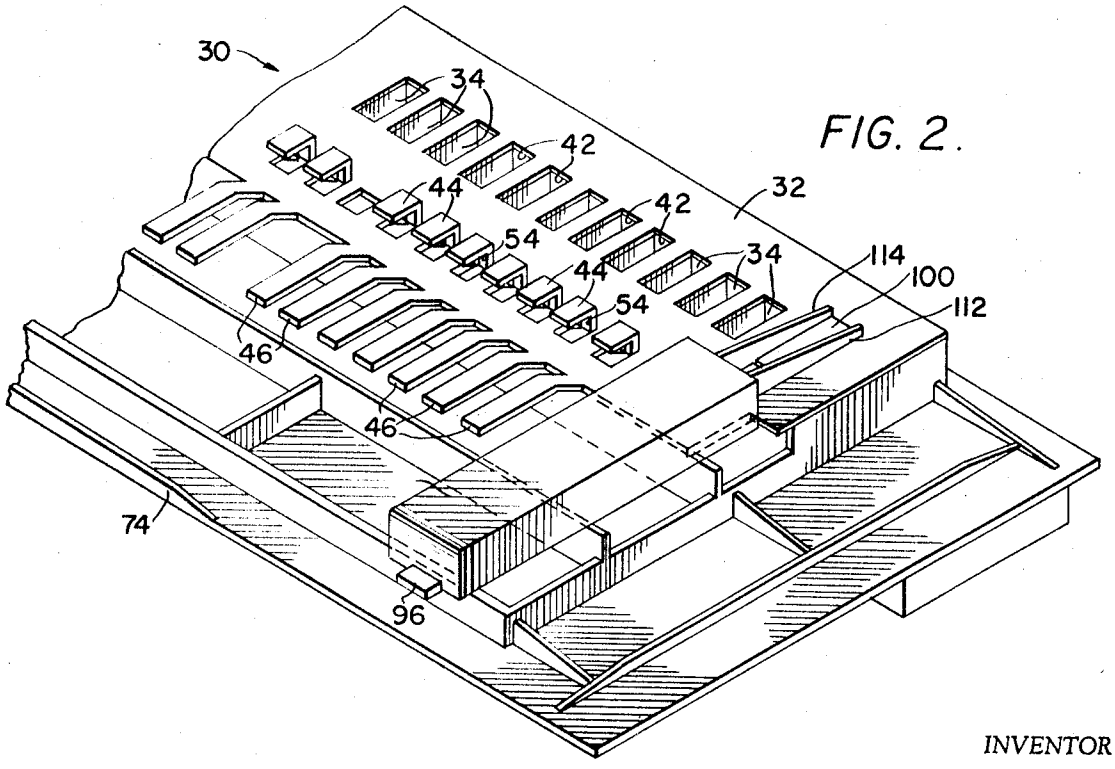


FIG. 2.



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FIG. 3.

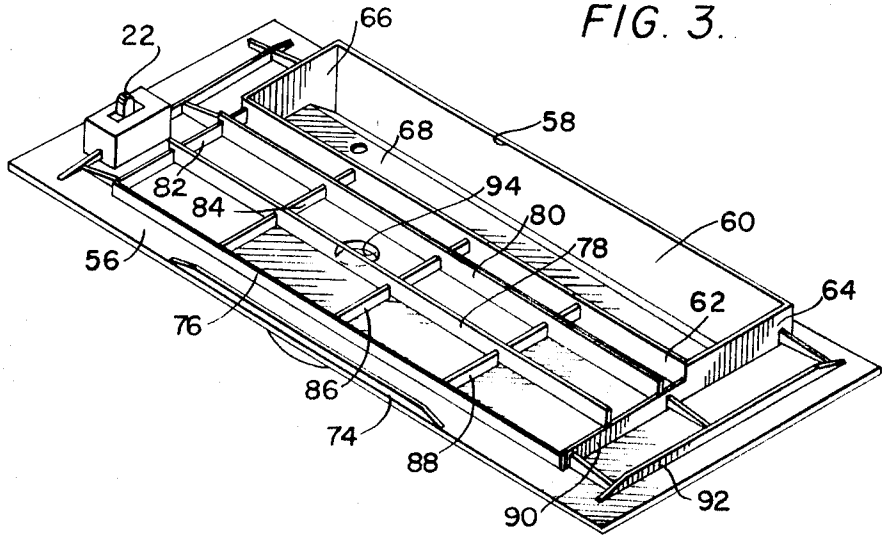
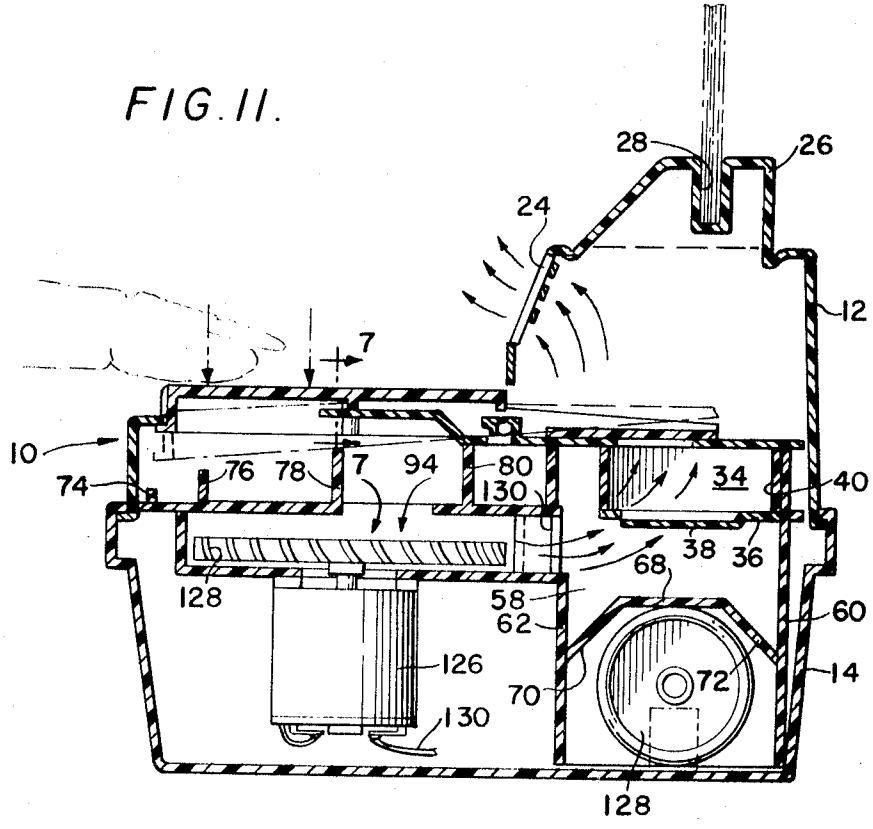


FIG. 11.



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FIG. 4.

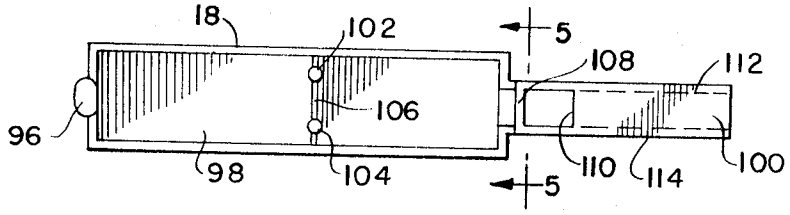


FIG. 9.

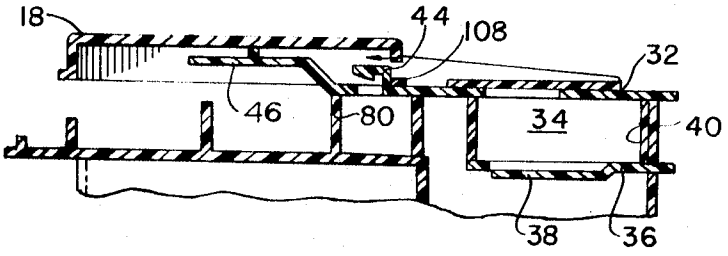


FIG. 10.

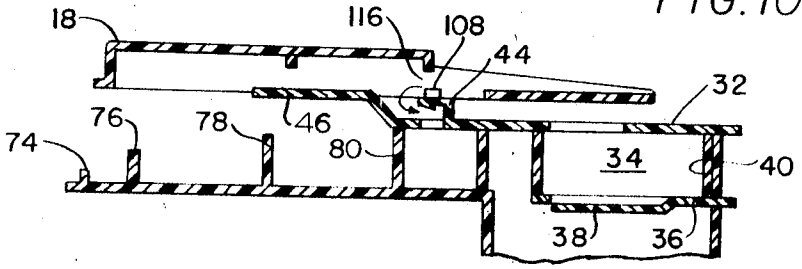


FIG. 5.

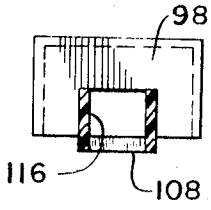


FIG. 6.

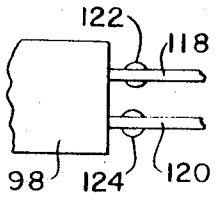


FIG. 7.

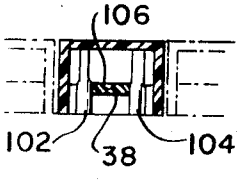
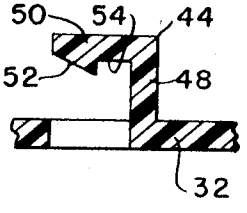


FIG. 8.



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MECHANICALLY BALANCED KEYBOARD AND REED CHAMBER ASSEMBLY FOR MUSICAL INSTRUMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention - The instant invention relates generally to significant improvements in musical instruments, and more particularly to the configuration of the keyboard and reed chamber assembly of a portable, air-operated musical instrument such as a toy organ or accordion.

2. Description of the Prior Art - Air-operated reed instruments which are executed in plastic are well-known, but have met with limited commercial acceptance because of their relatively expensive price. Exemplary instruments are manufactured by General Electric Co. and by Emenee Industries, Inc. formerly of Flushing, New York, but presently located in Bryan, Ohio. A third exemplary instrument is disclosed in U.S. Pat. No. 2,659,261 awarded to Finn H. Magnus et al. In all three of these instruments, musical tones are produced by unblocking a normally sealed resonance chamber to permit the passage of air past a reed plate and thence through a resonance chamber.

The first two instruments noted above employ a keyboard assembly including a plurality of plastic keys with holes at their pivot points, a plurality of metal support bars, a longitudinally extending rod which extends through all of the keys to mount same for pivotal movement, and a coil spring associated with each key to exert a downward pressure on the key stop. The key stop normally seals off the individual resonant chamber with which it is operatively associated.

The keyboard assembly is held in operative position atop the reed chamber by long screws or bolts. Such complicated and cumbersome assembly exerts a considerable downward force on the reed chamber assembly, with the maximum force being realized at the unsupported center section of the reed chamber assembly. Thus, the reed chamber assembly tends to bow or arc downwardly at its midsection.

The bowing or arcing causes misalignment of the keys on the keyboard and alters the normally sealed relationship between each resonant chamber and each key stop, thereby introducing air leaks. Even more significantly, the arcing exerts a substantial torquing pressure on the reeds. The torquing pressure may be of sufficient magnitude to twist the reeds out of aligned relationship with the reed chamber assembly; at the very least, the torquing pressure may twist the reeds so that the desired tonality is lost.

In order to prevent arcing of the reed chamber assembly, expensive modifications have been made within the larger air chamber into which the reed chamber is disposed. For example, metal braces or heavy molded support sections have been added to the air chamber to resist the downward arcing. Alternatively, upwardly directed spring loaded suspension devices have been employed to offset the torquing pressure.

The keyboard assembly of the Magnus et al patent theoretically overcomes some of the structural and functional shortcomings noted above. However, while the above noted longitudinally extending common pivot bar is eliminated, great difficulty would be experienced in accurately seating and anchoring the curved leaf springs (shown in FIG. 6 of the patent), in the groove at the rear of a comb section. Furthermore, considerable skill would have to be exercised in molding the keys and the ledges that engage the top and bottom surfaces of such keys when they are held in operative position.

Additionally, with each of the above described instruments, the entire keyboard assembly must be assembled prior to insertion into the instrument housing, and the entire keyboard must be disassembled for the repair or replacement of even a single reed. Obviously, this procedure is burdensome and expensive.

SUMMARY

Thus, with the deficiencies of the prior art instruments enumerated above in mind, the invention contemplates an air-operated reed instrument characterized by a mechanically balanced keyboard and reed chamber assembly. The keyboard and reed chamber assembly, when secured together, assume a state of mechanical equilibrium that minimizes, if not entirely eliminates, the downwardly directed forces that tend to bow reed plates out of operative alignment.

The invention further contemplates a keyboard and a reed chamber unit that are fabricated from a minimum number of inexpensive molded plastic components and are thus readily assembled in production and disassembled for repairs.

Additionally, the invention contemplates a reed chamber assembly with integrally molded pivot posts and anchored springs, as well as keys of unique configuration that can be facilely snapped into locking engagement with the pivot posts on the reed chamber assembly.

Other objectives, advantages and desirable features of the instant invention will become apparent in light of the following detailed description of the invention when construed in connection with the accompanying sheets of drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an air-operated musical organ constructed in accordance with the principles of the instant invention;

FIG. 2 is a perspective view, on an enlarged scale, of the reed chamber unit with one key of the keyboard secured thereto and the remaining keys omitted for the sake of clarity;

FIG. 3 is a perspective view of the support plate upon which the reed chamber unit is operatively disposed;

FIG. 4 is a bottom plan view of a representative key of the keyboard;

FIG. 5 is an elevational view of the rear face of the finger pad of the key, such view being taken near the midsection of the key, as indicated by line 5—5 in FIG. 4 and in the direction indicated;

FIG. 6 is a fragmentary top plan view of an alternative embodiment of the key employed in the instant invention;

FIG. 7 is a vertical cross-sectional view of the midportion of the finger pad of a key, such view being taken along line 7—7 in FIG. 11 and in the direction indicated;

FIG. 8 is a side elevation view, on an enlarged scale, of a post formed on the upper surface of the reed chamber assembly;

FIG. 9 is a side elevation of a fragment of the organ showing a key in the process of being secured to the reed chamber assembly;

FIG. 10 is a similar view showing the key secured to the reed chamber assembly; and

FIG. 11 is a side elevational view of the organ, such view being taken along line 11—11 in FIG. 1 and in the direction indicated.

DESCRIPTION OF THE INVENTION

Referring now in detail to the drawings in which similar reference numerals refer to similar parts, FIG. 1 depicts an organ indicated generally by reference numeral 10. Organ 10 comprises an upper casing 12 and a lower casing 14 which are secured together by interengaging tongues and grooves. A keyboard 16, including a plurality of whole-note keys 18 and a plurality of black half-note keys 20, extends horizontally across the organ. Keys 18 and 20 are similar in configuration.

An on-off switch 22 is situated at the left hand side of casing 12. As described in detail hereinafter, switch 22 controls the operation of a blower motor that produces the flow of air that passes through instrument 10 for producing tones. Grille 24 permits the air to escape from the interior of the instrument to the atmosphere. A music stand 26 is provided atop casing 12, and slot 28 in stand 26 receives a sheet or booklet of music to be played.

FIG. 2 illustrates, on an enlarged scale and with the casing 12, 14 removed, the details of the right end of the reed chamber assembly employed in instrument 10. The reed chamber assembly is designated generally by reference nu-

meral 30, and includes an upper wall 32 and a series of downwardly extending divider walls 34. A reed plate 36 with a series of spaced tuned reeds 38 is secured to walls 34 at a right angle thereto, as shown in FIGS. 9–11. When viewed in end elevation, reed plate 36 and divider walls 34 define a series of rectangular resonance chambers 40 that enhance the tonal qualities of reeds 38. Divider walls 34 are spaced apart so that each reed is supplied with its own resonance chamber 40 and each chamber has a rectangular port 42 at its upper end. Port 42, permits air to pass through chamber 40 under control of keyboard 16.

A series of integrally molded posts 44 and a like series of integrally molded anchor springs 46 are laterally spaced across wall 32. Springs 46 extend upwardly and outwardly from wall 32 to enhance their resiliency.

Posts 44 (as shown in FIG. 8) comprise a vertical arm 48 and a horizontal arm 50. A short tapered segment 52 and a locking groove 54 are formed in the undersurface of arm 48. As will become apparent at a later point in the specification, the pivot means for keys 18 is snapped behind segment 52 and into groove 54 when key 18 is secured to reed chamber assembly 30.

FIG. 3 depicts the molded plastic plate 56 which serves as a support for assembly 30. Switch 22 is located at one side of the plate, and an upwardly opening air chamber 58 is formed at the rear of the plate. As more fully illustrated in FIG. 11, the major extent of chamber 58 is defined by sidewalls 60, 62 and end walls 64, 66. The lowermost profile of the chamber is defined by a centrally located, horizontally extending wall 68 with sloping sidewalls 70, 72.

The dimensions of air chamber 58 are selected so that upper wall 32 can be joined to the side and end walls thereof with reed plate 36 spaced above, and parallel to wall 68. Phrased in another manner, resonance chambers 42 of reed chamber assembly 30 extend downwardly into operative relationship with air chamber 58.

Lip 74 is located near the forward end of plate 56 to facilitate the positioning of the plate within casing 12, 14. A series of spaced lateral struts 76,78 and 80 are located between lip 74 and sidewall 62 of the air chamber. Lateral strut 80 supports all of the anchored springs 38 at a juncture near the front edge of wall 32. A series of spaced longitudinal struts 82, 84, 86, 88, 90 and 92 intersect the lateral struts. An aperture 94 in plate 56 is provided for the passage of air from one side to the other side of the plate.

Turning now to FIGS. 4 and 5, the details of the integrally formed, molded plastic key 18 can clearly be seen. Starting at its front end and working toward its rear end, key 18 includes a tab 96, a hollow finger pad 98 of substantially rectangular configuration, and a rearwardly extending key stop 100.

Tab 96 engages a ledge on upper casing 12 to define the normal horizontal position of key 18.

A pair of lugs 102,104 and a bridging member 106 are formed on the underside of pad 98. The lugs are spaced apart a distance slightly greater than the width of anchored springs 38 so that the springs are seated on bridging member 106 when the keys are secured to reed chamber assembly 30. The assembled relationship is best shown in FIG. 7.

Pivot bar 108 is situated at the forward end of key stop 100, and a substantially rectangular alignment slot 110 is formed adjacent thereto. Tapered reinforcing walls 112 and 114 extend along the length of key stop 100. A locking notch 116 is formed in the rear face of finger pad 98. As described hereinafter with reference to FIGS. 9 and 10, notch 116 assists in the locking engagement of pivot bar 108 with the locking groove 54 on each post 44 on reed chamber assembly 30.

FIG. 6 suggests another manner of individually locking each key 18 to reed assembly unit 30. In this embodiment, laterally extending pivot bar 108 is replaced by a pair of spaced longitudinally extending rods 118 and 120. These rods are received in appropriate slots in the upper surface of vertical pivot shafts 122 and 124.

The manner in which each key 18 is individually snapped into locking relationship with reed chamber assembly 30 is shown in FIGS. 9 and 10. Key 18 is placed on upper wall 32 of assembly 30 with pivot bar 108 contacting the rear face of vertical arm 48 of post 44. The key is slid along the contour of post 44, i.e., upwardly along horizontal arm 50, and then slightly downwardly along tapered arm 52 until locking groove 54 is reached. Upon reaching the groove, pivot bar 108 is snapped into locking engagement with groove 54 by upward force exerted by the inherent resiliency of anchored spring 38. Arm 48 of post 44 extends forwardly through locking notch 116 (FIG. 5) in the rear face of finger pad 98. Slot 108 in key stop 100 assists in the proper alignment of each key 18 with respect to its post 44. Lugs 102, 104 and bridging member 106 (FIG. 4) also assist in the alignment of the key with respect to anchored spring 38. Lateral strut 80 contacts the underside of the anchored springs to support and strengthen same while enhancing the resiliency thereof. The directional arrow in FIGS. 9 and 10 show the path of movement of pivot bar 108 along post 44. When securely seated, pivot bar 108 serves as the fulcrum point for the pivotal movement of each key 18 with respect to assembly 30.

The manner in which instrument 10 is operated is briefly described with particular reference to FIG. 11 and more general reference to FIGS. 1–10. First, the player moves switch 22 to its on-position to complete a circuit (not shown) between a fractional horsepower motor 126 and the power source 128, which energizes the motor over leads 130 in a well-known fashion. Motor 126 is secured to the underside of plate 56, while power source 128, which may assume the form of a series of flashlight batteries, is disposed in lower casing 14 below air chamber 58.

Then the player depresses at least one key 18 so that the key pivots about bar 108 out of its normal horizontal orientation. Such pivotal movement, which is indicated by the dotted outline in FIG. 11, removes key stop 100 from its normal sealing engagement with the port 42 at the top of resonance chamber 40. Motor 126 drives a rotor 128 which draws air out of the front end of the casing through aperture 94 in plate 56 and forces the air through opening 130 into air chamber 58. Since the removal of key stop 108 from port 42 atop resonance chamber 40 creates a pressure differential, the air rushes past tuned reed 38, through chamber 40, and vents to the atmosphere through grille 24 in upper casing 12. The air rushing past reed 38 causes same to sound the desired tone. The direction of the flow of air through the casing is indicated by appropriate directional arrows.

The foregoing is a description of a preferred and alternative embodiment which are exemplary in nature. Manifestly, the invention is not limited in scope to the specific configurations detailed above, but includes all such variations as fall within the spirit and scope of the inventive concepts embraced by the instant invention.

I claim:

1. A portable musical instrument comprising:
   a. a housing having openings therein for the passage of air into and out of said housing,
   b. means for forcing air through the openings in said housing,
   c. a reed chamber assembly disposed within said housing in operative relationship to said openings,
   d. said assembly including a reed plate having a series of tuned vibratable reeds secured thereto and a series of resonance chambers operatively associated with said reeds,
   e. each of said resonance chambers having an upwardly opening port at its upper end,
   f. a keyboard including a plurality of manually operable keys,
   g. each of said plurality of keys including a finger pad and a key stop,
   h. said key stops normally sealing said ports in said resonance chambers and being operable, when

depressed, for opening said ports to allow the air to be forced past said reed to produce a tone, the invention being characterized by:

i. individual key locking means formed on said reed chamber assembly, said key locking means comprising a plurality of upstruck posts spaced along the upper wall of said reed chamber assembly, said posts and said keys being equal in number,

j. each of said keys further including pivot means located intermediate said finger pad and said key stop, and

k. the pivot means on each key being snapped into engagement with its locking means for individually securing each one of said keys in mechanical equilibrium to said reed chamber assembly.

2. A portable musical instrument as defined in claim **1** further characterized in that each of said posts includes a vertical arm and a horizontal arm.

3. A portable musical instrument as defined in claim **2** further characterized in that the underside of each of said posts includes a tapered section with a groove formed adjacent thereto.

4. A portable musical instrument as defined in claim **1** wherein said pivot means assumes the form of a laterally extending bar.

5. A portable musical instrument as defined in claim **1** wherein said pivot means assumes the form of a pair of spaced longitudinally extending rods.

6. A portable musical instrument as defined in claim **1** wherein said key is further characterized by an alignment slot located in the key stop adjacent to said pivot means.

7. A portable musical instrument as defined in claim **2** wherein said key is further characterized by a locking notch formed in the rear face of said finger pad, said notch being of sufficient size to enable one of said posts to pass therethrough.

8. A portable musical instrument as defined in claim **1** wherein said reed chamber assembly is further characterized by a plurality of integrally formed, laterally spaced anchor springs, said springs being equal in number to said posts and said keys, each of said springs individually biasing one of said keys.

9. A portable musical instrument as defined in claim **8** wherein the underside of the finger pad of each key includes a pair of lugs and a bridging member, said lugs being spaced apart a distance slightly greater than the lateral dimension of said anchored springs so that said springs can rest upon said bridging member.

10. A portable musical instrument as defined in claim **8** wherein said reed chamber assembly is further characterized by a horizontally expanding plate which supports said assembly within said casing, said plate having at least one laterally extending strut formed thereon, said strut providing support for all of said anchored springs.

11. A molded plastic key adapted to be used in a portable musical instrument, said key comprising:

a. a forwardly extending finger pad and a rearwardly extending key stop, said pad having a rear face,

b. pivot means formed between said finger pad and said key stop, and

c. a locking notch formed in said rear face of said finger pad.

12. A key as defined in claim **11** wherein each key further comprises an alignment slot situated in said key stop behind said pivot means.

13. A key as defined in claim **11** wherein the finger pad of each of said keys is hollow, and each key further comprises a pair of spaced lugs and a bridging member formed on the underside of finger pad.

14. A molded plastic reed chamber assembly adapted to be used in a portable musical instrument, said reed chamber assembly comprising:

a. a reed plate having a plurality of tuned vibratable reeds formed thereon,

b. a like plurality of resonance chambers disposed in operative relationship to said reeds, and

c. a like plurality of individual, laterally spaced key locking means adapted to receive and engage keys of a keyboard, each of said key locking means comprising an upstruck post laterally spaced along the upper wall of said reed chamber assembly, said reeds, resonance chambers and key locking means being equal in number.

15. A reed chamber assembly as defined in claim **14** wherein each post comprises a vertical arm, a horizontal arm, and a tapered section with a groove formed adjacent thereto on the underside of each post.

16. A method of individually securing each molded plastic key of a plurality of keys on a keyboard to a molded plastic reed chamber assembly of a portable musical instrument, each key having an integrally formed pivot means, the reed chamber assembly including a plurality of upstruck posts laterally spaced along its upper wall, said method comprising the steps of:

a. individually positioning each key adjacent to its upstruck post with its locking means abutting thereagainst, and

b. sliding each key along the contour of its post until its pivot means snaps into separate locking engagement therewith.

17. A method of individually securing each molded plastic key of a plurality of keys on a keyboard to a molded plastic reed chamber assembly of a portable musical instrument, each key having an integrally formed pivot means, the reed chamber assembly including a plurality of upstruck posts and anchor springs laterally spaced along its upper wall, the keys, posts and springs being equal in number, said method comprising the steps of:

a. individually positioning each key adjacent to its upstruck post with its locking means abutting thereagainst, and

b. sliding each key along the contour of its post until its pivot means snaps into separate locking engagement therewith and its anchor spring biases each key upwardly.

* * * * *