

History of the ELX

- circa 1990 – experimental studies on harmonica reed dynamics accidentally results in realization that reed motion when converted to voltage, can then be translated to sound.
- circa 1996 – first piezo electric prototype
- circa 1999 – piezo model is “perfected” however has significant drawbacks. Presented to Hohner, who expressed no interest.
- circa 2002 – eddy current sensor
- circa 2002 – capacitive sensor
- 2003 – patent filed
- 2004 – first prototype using optical sensor using simple passive summer circuit. Worked “ok” but gain was uneven across reeds (very weak for the high reeds) and there was unacceptable hiss.
- 2005 – second optical prototype designed by Tom Dragness including on-board preamplifiers. Sensors changed from Optek to Omron to save cost. This harp was configured as quadraphonic: high register separated from low, draw from blow, patched to mini quad mixer (Nobels.) Drawbacks included complexity, difficulty to replace harp bodies (requiring disassembly of lids), and ongoing problem of hiss.
- 2008 – retained Daedalus to re-design ELX to deal with manufacturability issue and hiss. They redesigned the circuit, and produced 5 prototypes, but not much was changed, except convert from four channel to one (for sake of simplicity, obviating 4-channel mixer.) The manufacturability issue was never addressed.
- 2009-at wits end, Prof Turbodog decides to take matters into his own hands, and redesigns the covers to permit easy exchange of harp bodies. Returns to Daedalus for minor revisions to circuit, particularly replacing sensors which had been discontinued by Omron by Fairchild sensors. Added pot's to each of the reeds to balance gain; Also inverted summation of blow and draw (based on suggestion of Harmonica John) to prevent cancellation when bending notes. Also added on-board connector along with other improvements to improve manufacture, assembly, and adjustment.
- 2011 – retained Novodyne (Burbank, CA) to produce circuit boards.
- 2011, November 7 – first 5 boards arrived. Assembled to 5-sets of rapid-prototype lids to produce the first five “production” ELX's.
- April 2012 – Novodyne loses lease, goes out of business; runs off with our down payment.
- ca June 2012 – we find another supplier of circuit boards, and conduct another round of debugging, and minor revisions.
- August 17, 2012: first set of 100 circuit boards received, full production initiated.
- ...and the beat goes on...



US 6326,532 B1

(3) United States Patent
Anteki

(11) Patent No.: US 6326,532 B1
(12) Date of Patent: Dec. 4, 2001

(54) HARMONICA HAVING REED VIBRATION CONVERSION CAPABILITY AND ASSOCIATED RETROFITTING METHOD

(73) Inventor: James R. Anteki, 437 Mount Royal Blvd., Falls Church, VA 22034

(75) Assignee: Harmonica Patent, LLC, 437 Mount Royal Blvd., Falls Church, VA 22034

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(d) by 6 days.

(21) Appl. No.: 09/632,787
(22) Filed: Dec. 3, 1999
(51) Int. Cl.: G10D 7/12
(52) U.S. Cl.: 84/277
(53) Field of Search: 84/277, 376, 379

References Cited

U.S. PATENT DOCUMENTS

5,477,312	9/19/98	Wright	84/777
5,282,120	4/2/92	Wright	84/777
5,282,121	4/2/92	Wright	84/777
5,306,122	3/27/91	Hawkins	84/777
4,969,912	4/2/90	Harmonica	84/111
4,097,075	10/1/86	Harmonica	84/111
4,944,889	1/15/90	Harmonica	84/111
5,383,181	10/30/90	Wright	84/777
5,263,017	11/19/90	Wright	84/777
5,377,324	11/09/90	Wright	84/777

FOREIGN DOCUMENTS

52898 - 11/19/92 - G.T.

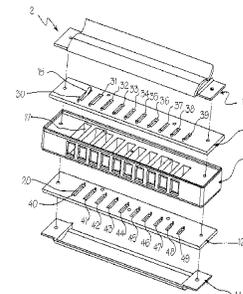
* cited by examiner

Primary Examiner: Tiber F. Napp
Assistant Examiner: Alan Linder
(21) attorney, agent, or firm: David V. Rindley, Robert Thomas Clark & Melick, LLC

(57) ABSTRACT

A retrofitted harmonica is disclosed that includes a plurality of reeds and reed supports associated with at least one of the reeds for conversion of mechanical vibration of the reed into electrical energy. The electrical signals are obtained and processed by a microcontroller having access to a digital-to-analog converter to produce a plurality of reeds on the one side of the harmonica. A variety of types and configurations for these sensors are provided to retrofit a particular harmonica to use reed-to-voltage conversion with the reeds in either the chromatic or the traditional diatonic configurations. The sensor based retrofits of the harmonica can be electrically connected to auxiliary signal conditioning equipment, such as stereo equipment or conventional amplification equipment to further enhance play. Methods for retrofitting a conventionally available harmonica with a basic one sensor based unit are also provided.

15 Claims, 14 Drawing Sheets



HARMONICAS OF THE FUTURE

TurboHarp/ELX

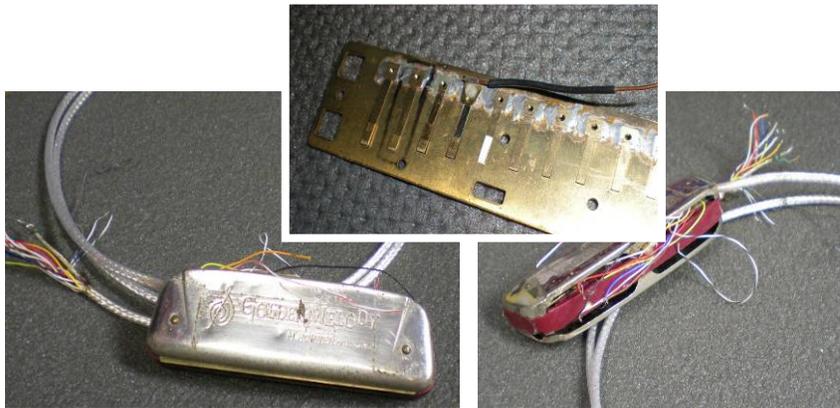


Origins of the ELX

circa 1991 – original “breadboard” version – originally intended for experimentation on physics of reed dynamics. Two eddy current proximity sensors used.



circa 1996: Piezo version: flexible plastic sensors painstakingly bonded to each reed. Wire attachment was a big problem.



circa 2001: Improved piezo version: wire attachment problem “solved” kind-of. But still painstaking, and resulted in unacceptable damping. Note brief venture into using Lee Oskar bodies.



TurboHarp/ELX

A

Origins of the ELX

circa 2003: Attempt at proximity sensors integrated into the comb.



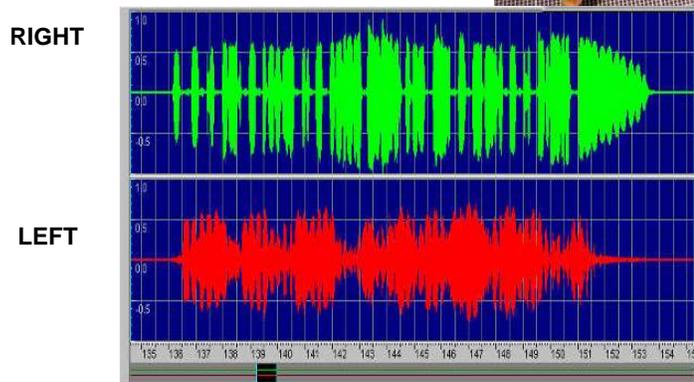
circa 2004: First optical pickup version. 4 channels: low notes blow, low draw, high blow, high draw



- Optical sensors (pickups) convert reed vibration to electrical signal.
- Used standard harmonica body
- Required disassembly of lids (by 2 allen screws) to swap harmonica bodies.



•Quad output: blow-draw; low-high registers



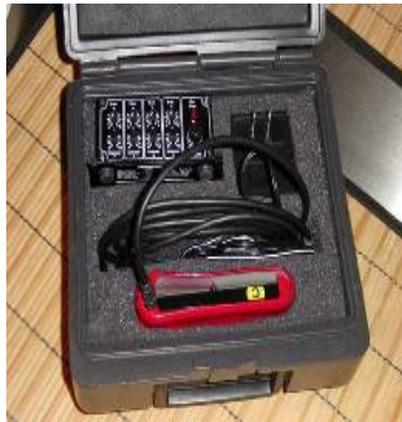
4 channels from harp:

- Low blow
- Low draw
- High blow
- High draw

Origins of the ELX: Generation-2 Optical - circa 2004



•Experimented with various effects boxes, including Line-6, POD, Pandora Box, Digitech RP50, and RP70, and others.



circa 2004:
refined 4-channel mixer.



circa 2003: Demo CD

The TurboHarp/ELX is the world's first truly electronic harmonica. This CD contains sound samples of the first prototype demonstrating the unique abilities of the ELX.

(01) On Stage™	0:10
(02) Drive Bender™	0:18
(03) High Scale™	0:30
(04) High Scale™	0:40
(05) Cherry Pick™ and Apple Blossom™	0:48
(06) Cherry Pick™	0:48
(07) Dil Jus Clean™	0:20
(08) Dil Jus Clean™	0:30
(09) Dil Jus Clean™	0:24
(10) How Great's Day Raps™	0:28
(11) "Surrey"™	0:56
(12) "Surrey"™	0:46
(13) "Surrey"™	0:28
(14) "Surrey"™	0:40
(15) "Voice of Spring"™	0:40
(16) On Stage™ (reprise)	0:20

* Stereo: on left channel and Chorus on right channel
 ** Stereo: Right channel on how wide
 *** Stereo: on left channel
 † Mono: on left channel
 ‡ Recorded acoustically from a harmonica

ANTAKAMATICS, INC
 3500 FITZ AVENUE, STE. 203
 PITTSBURGH, PA 15203
 412/262-0431
 www.turboharp.com

TURBOHARP/ELX - DEMO CD -