(12) **United States Patent**
DeLine et al.

(10) **Patent No.:** **US 6,420,975 B1**
(45) **Date of Patent:** ***Jul. 16, 2002**

(54) **INTERIOR REARVIEW MIRROR SOUND PROCESSING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/466,010**

(22) Filed: **Dec. 17, 1999**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/449,121, filed on Nov. 24, 1999, and a continuation-in-part of application No. 09/448,700, filed on Nov. 24, 1999, now Pat. No. 6,329,925, and a continuation-in-part of application No. 09/433,467, filed on Nov. 4, 1999, now Pat. No. 6,326,613, and a continuation-in-part of application No. 09/396,179, filed on Sep. 14, 1999, now Pat. No. 6,278,377, which is a continuation-in-part of application No. 09/382,720, filed on Aug. 25, 1999, now Pat. No. 6,243,003.

(51) **Int. Cl.**^{7} **B60Q 1/00**; H04R 29/00
(52) **U.S. Cl.** **340/815.4**; 340/425.5; 381/56; 381/86; 381/169; 381/361; 381/365
(58) **Field of Search** 340/315.4, 425.5; 381/71.1, 71.4, 56–58, 86, 91; 379/454, 446; 455/74.1, 569, 566, 567, 575, 90, 99, 100

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,972,018 A	2/1961	Hawley et al.	....	179/1
3,098,121 A	7/1963	Wadsworth	....	179/1
4,052,568 A	10/1977	Jankowski	....	179/15
4,187,396 A	2/1980	Luhowy	....	179/1
4,484,344 A	11/1984	Mai et al.	....	381/46
4,736,432 A	4/1988	Cantrell	....	381/83
4,833,719 A	5/1989	Carme et al.	....	381/72

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

JP	3169199	7/1991
JP	10036144 A	2/1998
JP	10330131 A	12/1998
JP	11050006 A	2/1999
WO	WO 9734780	9/1997
WO	WO 9817046	4/1998
WO	WO 9830415	7/1998

OTHER PUBLICATIONS

Adaptive Noise Cancelling: Principles and Applications, Proc. IEEE, vol. 63, pp. 1692–1716, Dec. 1975 by B. Widrow et al.
Adaptive Noise Cancelling for Speech Signals, IEEE Trans. Acoust. Speech and Signal Proc., vol. ASSP–26, No. 5, Oct. 1978 by M. Sambur.

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(57) **ABSTRACT**
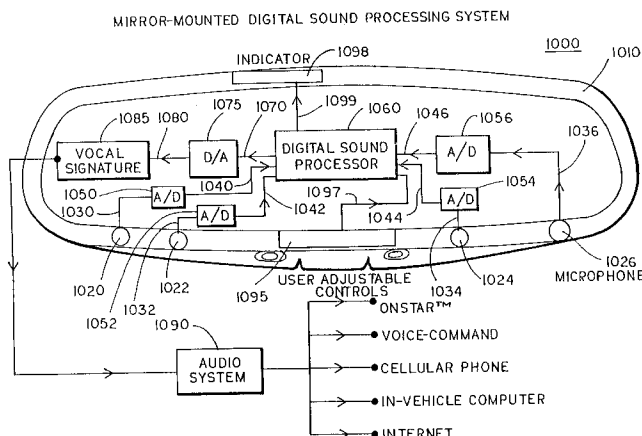
A digital sound processor is provided to enhance the vocal to non-vocal noise ratio of the signal processed by a vehicle audio system such as a cellular telephone, emergency communication device, or other audio device. Optionally, an indicator is provided for use with the vehicular audio system in order to provide a user of the audio system with a status signal relating to a reception quality of a vocal signal from the user. The microphone of the audio system may be mounted within an accessory module, which may be mounted to an interior surface of a vehicle windshield. The accessory module provides a fixed orientation of the microphone and is easily installed to the vehicle as it is manufactured or as an aftermarket device. The indicator may be mounted at the accessory module or elsewhere at the mirror assembly.

43 Claims, 10 Drawing Sheets

MIRROR-MOUNTED DIGITAL SOUND PROCESSING SYSTEM

U.S. PATENT DOCUMENTS

4,878,188	A		10/1989	Ziegler, Jr.	364/724.01
4,930,742	A	*	6/1990	Schofield et al.	248/475.1
4,959,865	A		9/1990	Stettiner et al.	381/46
4,977,600	A		12/1990	Ziegler	381/71
5,033,082	A		7/1991	Eriksson et al.	379/410
5,138,664	A		8/1992	Kimura et al.	381/72
5,178,448	A		1/1993	Adams et al.	362/83.1
5,251,263	A		10/1993	Andrea et al.	381/71
5,381,473	A		1/1995	Andrea et al.	379/387
5,530,240	A		6/1996	Larson et al.	250/214
5,546,458	A	*	8/1996	Iwami	379/390
5,550,677	A		8/1996	Schofield et al.	359/604
5,649,756	A		7/1997	Adams et al.	362/83.1
5,671,996	A		9/1997	Bos et al.	362/83.1
5,673,325	A		9/1997	Andrea et al.	381/92
5,673,994	A		10/1997	Fant, Jr. et al.	362/831
5,715,093	A		2/1998	Schierbeck et al.	359/601
5,715,321	A		2/1998	Andrea et al.	381/92
5,724,187	A		3/1998	Varaprasad et al.	359/608
5,732,143	A		3/1998	Andrea et al.	381/71.6
5,760,962	A		6/1998	Schofield et al.	359/604
5,786,772	A		7/1998	Schofield et al.	340/903
5,796,176	A		8/1998	Kramer et al.	307/10.1
5,798,575	A		8/1998	O'Farrell et al.	307/10.1
5,798,688	A		8/1998	Schofield	340/438
5,813,745	A		9/1998	Fant, Jr. et al.	362/83.1
5,820,245	A		10/1998	Desmond et al.	362/83.1
5,825,897	A		10/1998	Andrea et al.	381/71.6
5,877,897	A		3/1999	Schofield et al.	359/604
5,878,353	A	*	3/1999	ul Azam et al.	455/550
5,909,495	A		6/1999	Andrea	381/67
5,924,212	A		7/1999	Domanski	33/355
5,929,786	A		7/1999	Schofield et al.	340/903
5,938,321	A		8/1999	Bos et al.	362/494
5,971,552	A		10/1999	O'Farrell et al.	359/871
6,091,411	A		2/2000	Carter et al.	296/37.7
6,243,003	B1	*	6/2001	DeLine et al.	340/425.5

* cited by examiner

FIG.1

FIG.2

FIG.3

FIG.4

FIG.5

FIG.6

DOCKET ALARM
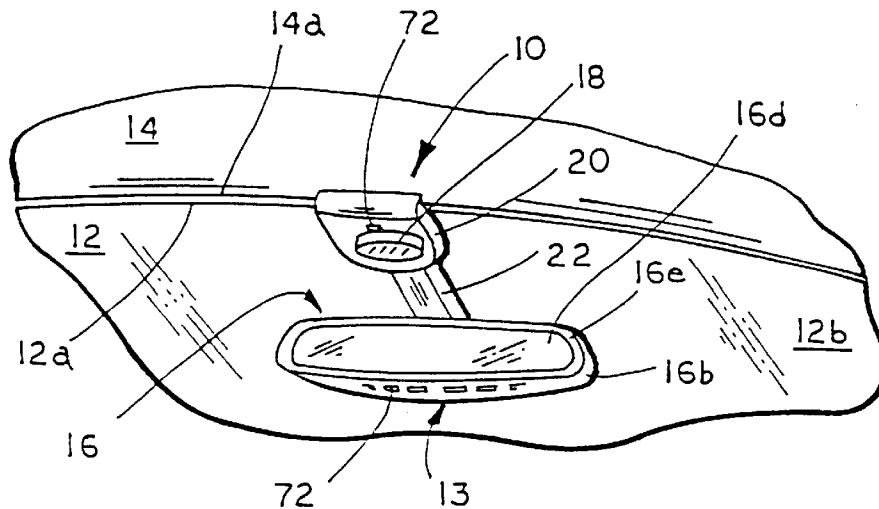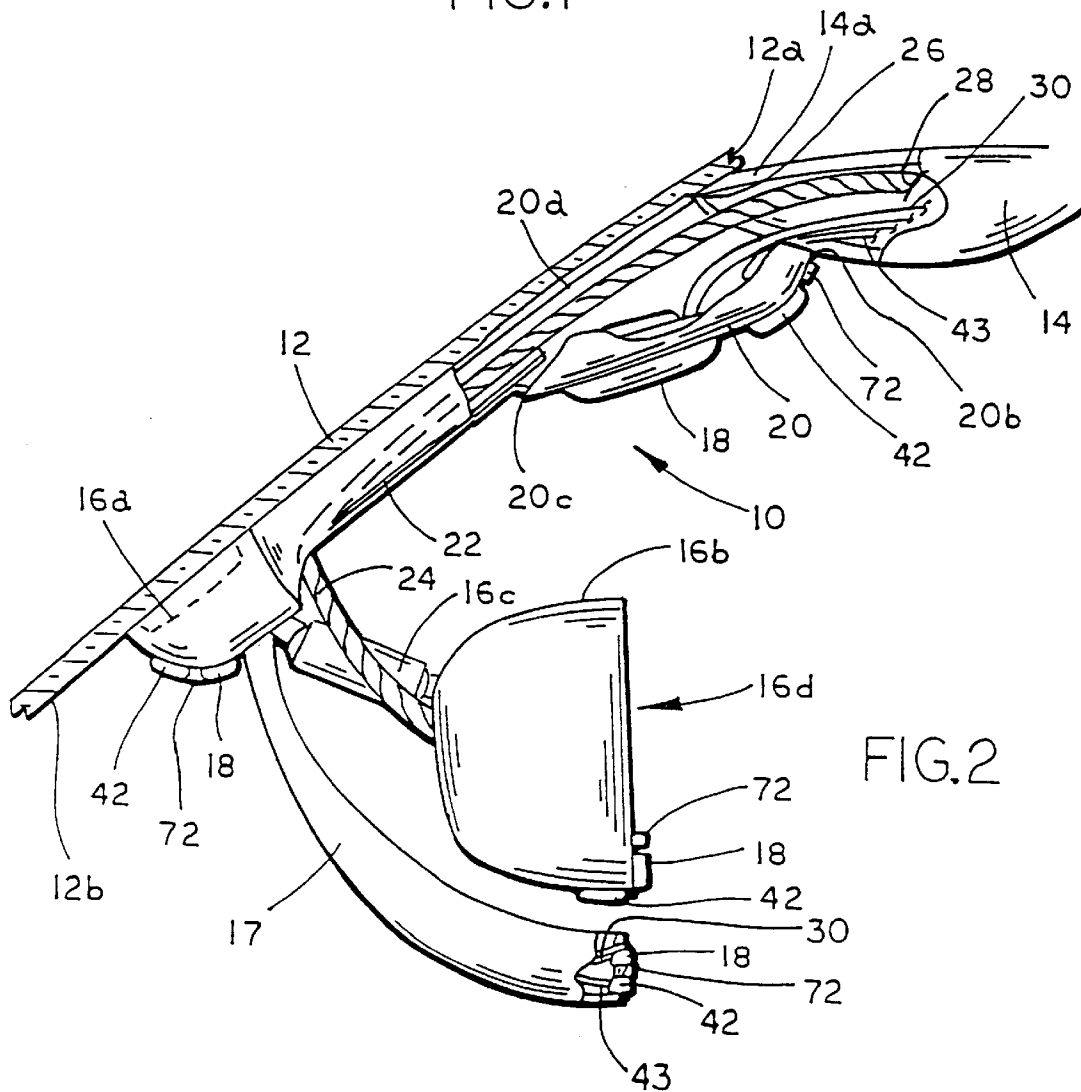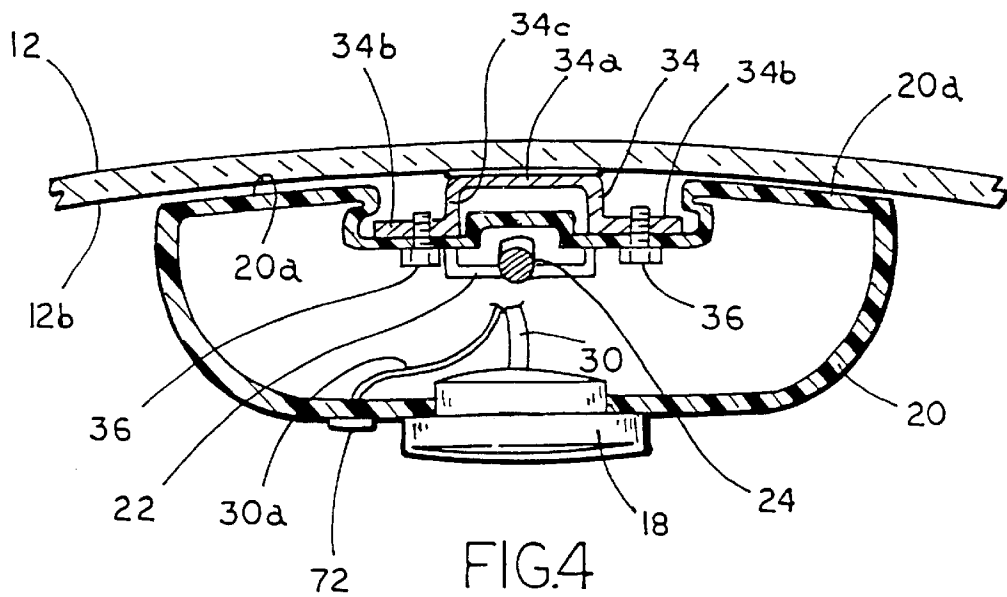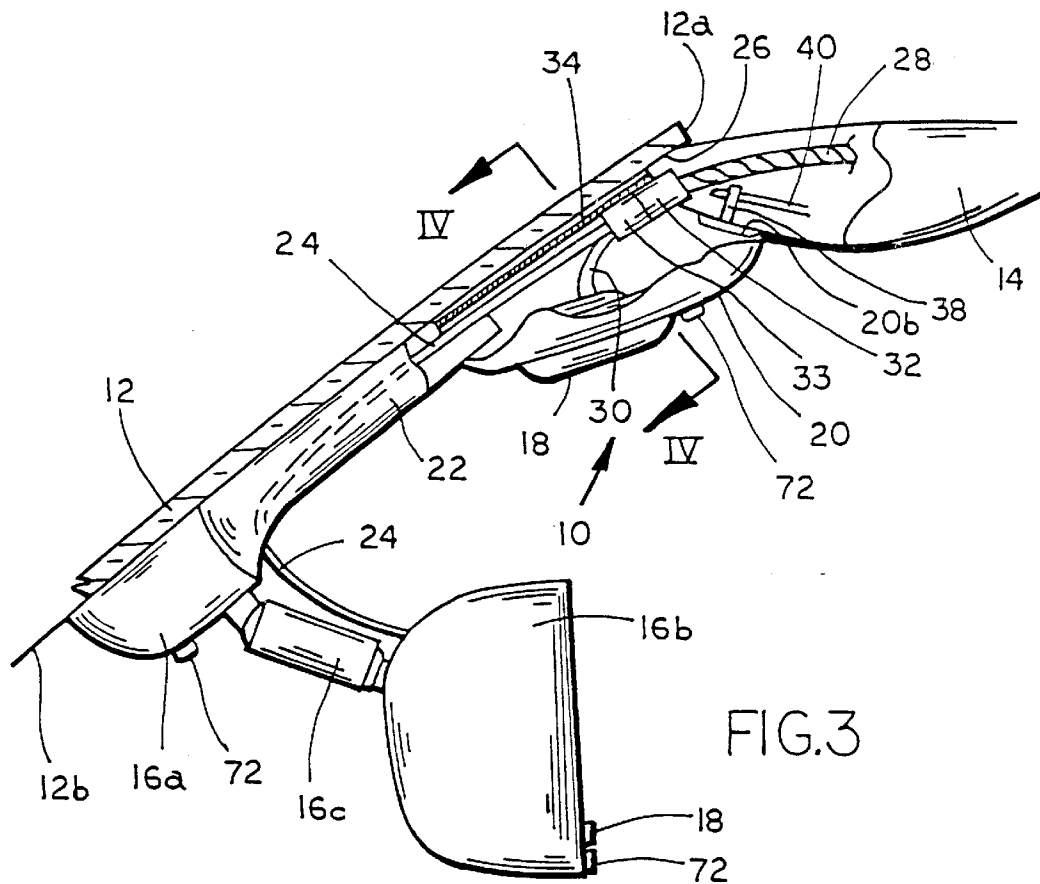
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