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(54) **TOOTH SHADE SCAN SYSTEM AND METHOD** 4,654,794 A 3/1987 O'Brien 433/215

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(Continued)

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FOREIGN PATENT DOCUMENTS

DE 19534517 9/1995

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OTHER PUBLICATIONS

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Benson (ed.), Visual Information Transmission, Television Engineering Handbook, pp. 4.3-4.76 (1986, McGraw-Hill).

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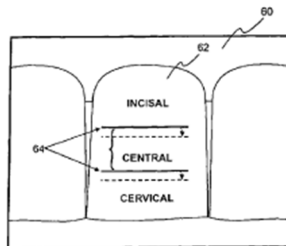
(52) **U.S. Cl.** 433/29; 356/402; 356/406
(58) **Field of Classification Search** 433/26, 433/203.1; 356/402, 405, 406, 407, 408
See application file for complete search history.

(57) **ABSTRACT**

A tooth shade scan system is provided that identifies tooth shades for a patient's tooth. An electronic database of tooth shade information for a shade guide may be stored. The database may include shade information based on tooth regions (e.g., the incisal, central, and cervical). A system operator may be shown an image of a patient's tooth on display equipment such as a computer monitor. An application running on the system may display dividers that the operator can manipulate to divide the image of the patient's tooth into regions. The regions may correspond to regions for which specific tooth shade information is available in the database. Values representative of a limited number of color characteristics for a region as a whole may be determined from the image. Corresponding categories of color characteristics may exist in the database, which is then used to identify tooth shades by region for the patient's tooth.

14 Claims, 6 Drawing Sheets

U.S. PATENT DOCUMENTS	
3,861,044 A	1/1975 Swinson, Jr. 32/17
3,975,760 A	8/1976 Yamana et al. 348/262
3,986,777 A	10/1976 Roll 356/176
4,016,598 A	4/1977 Yamana et al. 358/41
4,106,056 A	8/1978 Nagumo et al. 35/50
4,247,202 A	1/1981 Failes 356/310
4,414,635 A	11/1983 Gust et al. 364/526
4,518,258 A	5/1985 Beversma 356/405
4,547,074 A	10/1985 Hinoda et al. 356/405
4,575,805 A	3/1986 Moermann et al. 700/163
4,591,900 A	5/1986 Heeb et al. 358/44
4,616,933 A	10/1986 Leveque et al. 356/416
4,623,973 A	11/1986 Hoffrichter et al. 364/526



US 7,341,450 B2

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U.S. PATENT DOCUMENTS

4,692,481 A	9/1987 Kelly 523/210
4,813,000 A	3/1989 Wyman et al. 382/165
4,836,674 A	6/1989 Lequime et al. 356/319
4,881,811 A	11/1989 O'Brien 356/323
4,903,122 A	2/1990 Ozaki et al. 358/48
4,919,617 A	4/1990 Antons et al. 433/26
4,978,296 A	12/1990 Antons et al. 433/26
5,012,431 A	4/1991 Stanzola 382/162
5,027,138 A	6/1991 Gandrud 348/66
5,124,797 A	6/1992 Williams et al. 348/340
5,177,694 A	1/1993 Graham et al. 382/165
5,231,472 A	7/1993 Marcus et al. 356/402
5,240,414 A	8/1993 Thompson 433/26
5,273,429 A	12/1993 Rekow et al. 433/215
5,282,025 A	1/1994 Sato 348/273
5,313,267 A	5/1994 MacFarlane et al. 356/405
5,340,309 A	8/1994 Robertson 433/69
5,373,364 A	12/1994 Krzyminski 356/405
5,383,020 A	1/1995 Vieillefosse 356/405
5,430,811 A	7/1995 Fukushima et al. 381/254
5,431,562 A	7/1995 Andreiko et al. 433/25
5,434,604 A	7/1995 Cleary et al. 347/19
5,452,219 A	9/1995 Dehoff et al. 364/474.05
5,453,009 A	9/1995 Feldman 433/215
5,498,157 A	3/1996 Hall 433/26
5,549,476 A	8/1996 Stern 433/233
5,587,912 A	12/1996 Andersson et al. 433/215
5,685,712 A	11/1997 Fischer 433/26
5,690,486 A	11/1997 Zigelbaum 433/29
5,692,900 A	12/1997 Fischer 433/26
5,725,372 A	3/1998 Leon 433/26
5,733,126 A	3/1998 Andersson et al. 433/233
5,745,229 A	4/1998 Jung et al. 356/73
5,759,030 A	6/1998 Jung et al. 433/29
5,798,839 A	8/1998 Berner et al. 356/402

5,823,778 A	10/1998 Schmitt et al. 433/214
5,851,113 A	12/1998 Jung et al. 433/29
5,851,115 A	12/1998 Carlsson et al. 433/215
5,871,351 A	2/1999 Jung et al. 433/26
5,880,826 A	3/1999 Jung et al. 356/73
5,938,446 A	8/1999 Andersson et al. 433/25
6,008,905 A	12/1999 Breton et al. 356/402
6,030,209 A	2/2000 Panzera et al. 433/26
6,038,024 A	3/2000 Berner 356/326
6,058,357 A	5/2000 Granger 702/104
6,111,650 A	8/2000 Rawicz et al. 56/402
6,132,210 A	10/2000 Lehmann 433/26
6,244,863 B1	6/2001 Rawicz et al. 433/26
6,305,933 B1	10/2001 Lehmann 433/26
6,331,000 B1	12/2001 Lehmann 433/26
6,358,047 B2	3/2002 Lehmann 433/26
6,358,047 B2	3/2002 Lehmann 433/26
6,561,800 B2	5/2003 Lehmann 433/26
6,575,751 B1	6/2003 Lehmann et al. 433/223

FOREIGN PATENT DOCUMENTS

EP	036 0657	3/1990
JP	64-052455	2/1989
JP	01052454	2/1989
JP	4301530	10/1992
JP	4338465	11/1992
WO	WO 86 03292	6/1986
WO	WO 91 02955	3/1991
WO	WO 95 15731	6/1995

OTHER PUBLICATIONS

Internet Search for "Prosthetics" (Jun. 2001).
http://cortexmachina.com/products/e_shadescan.htm, Jun. 2001.
<http://www.issaquah-dl.com/>, Jun. 2001.
<http://www.mht.ch/mhtint/spectro.htm>, Jun. 2001.
http://www.xrite.com/product_overview.aspx?Line=13, Jun. 2001.