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United States Patent [19]

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Franklin et al.

[45] Date of Patent: Feb. 14, 1995

[54] METHOD AND APPARATUS FOR TACTILE TRANSDUCTION OF ACOUSTIC SIGNALS FROM TELEVISION RECEIVERS

[75] Inventors: David Franklin; Michael Wollowitz; John Simpson, all of Somerville, Mass.

[73] Assignee: Audiological Engineering Corporation, Somerville, Mass.

[21] Appl. No.: 717,665

[22] Filed: Jun. 19, 1991

[51] Int. Cl.⁶ H04R 25/00; G09B 21/00

[52] U.S. Cl. 434/114; 434/112; 340/407.1

[58] Field of Search 434/112, 113, 114, 116, 434/185; 340/825.19, 407, 384 R, 407.1; 341/21, 27; 381/68, 150, 151, 162, 191, 205

[56] References Cited

U.S. PATENT DOCUMENTS

4,250,637	2/1981	Scott	434/114
4,310,315	1/1982	Frank et al.	434/112
4,581,491	4/1986	Boothroyd	434/114
4,685,448	8/1987	Shames et al.	434/185
4,728,934	3/1988	Pfänder et al.	434/114

FOREIGN PATENT DOCUMENTS

0653197	12/1985	Switzerland	434/112
2044977	10/1980	United Kingdom	434/112
9116694	10/1991	WIPO	434/114

OTHER PUBLICATIONS

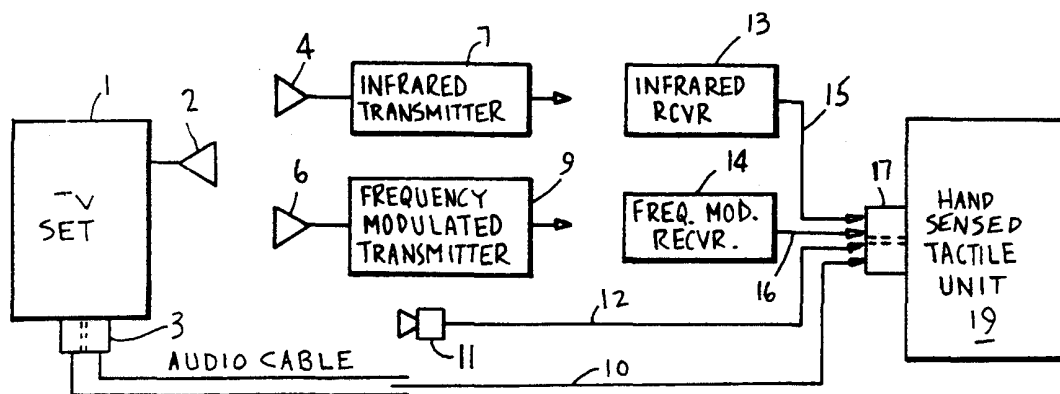
Franklin, David, "Tactileaids: What are they?" Hearing Journal, May 1988.

Primary Examiner—Jessica J. Harrison

[57] ABSTRACT

Inexpensive wideband transducers convert low frequency components (i.e., approximately 50 Hz through 800 Hz) of an audio signal to mechanical vibrations at the same frequencies so that the vibrations may be perceived at the user's skin, typically at a hand or finger. The transducer may be a small permanent magnet moving coil loudspeaker with most of the diaphragm cone removed to minimize soundwave generation, or it may be a small d.c. or stepping motor arranged to have its drive shaft rotated in alternate directions through small angles corresponding to signal amplitude. Vibrations may be applied to the user's hand through a hand-held case vibrating with the motor, or to a finger via a contactor extending outside the case from the motor or loudspeaker. The transducer has particular utility in conjunction with closed captioned in television programs to enhance appreciation of speech therein while also training the user in utilizing the transducer. One or more fixed frequency transducers may additionally be employed vibrations at a single frequency representing all of the higher frequency components in the audio signal.

23 Claims, 4 Drawing Sheets



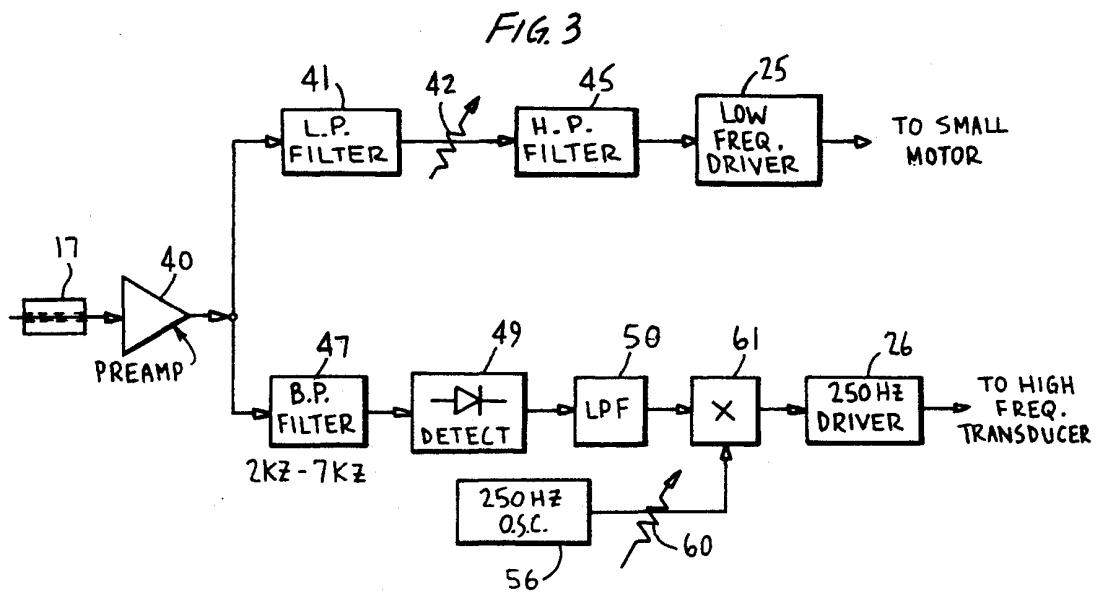
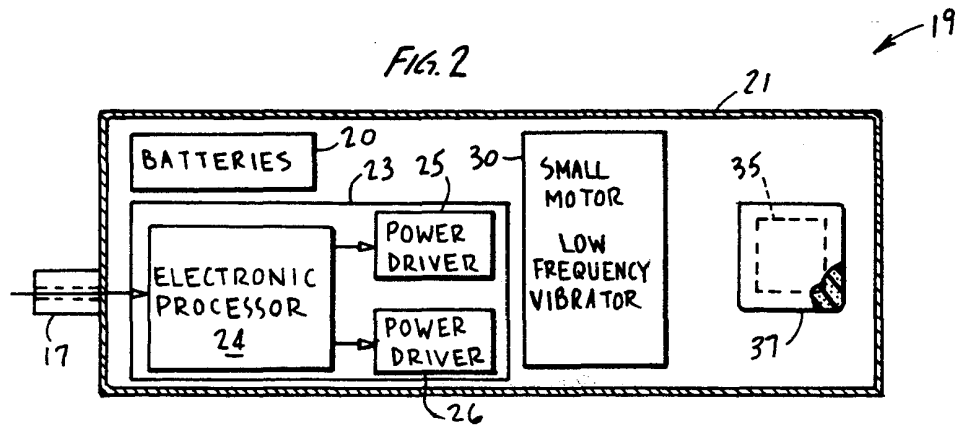
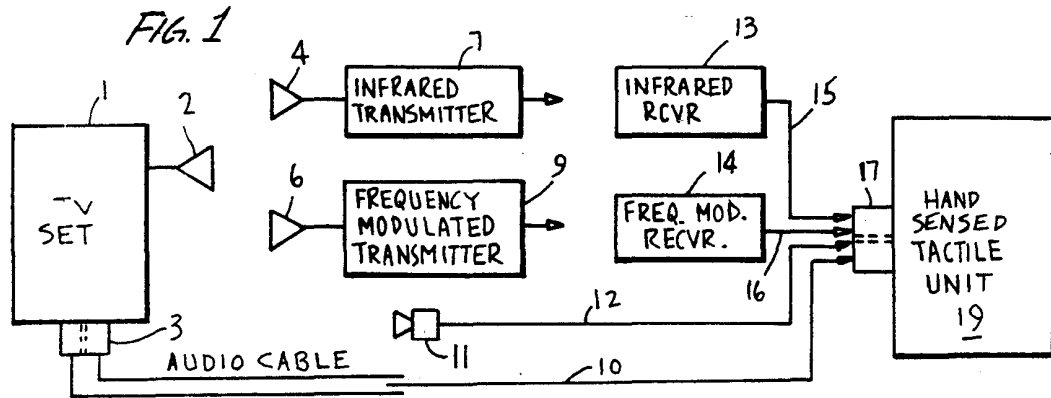


FIG. 4A

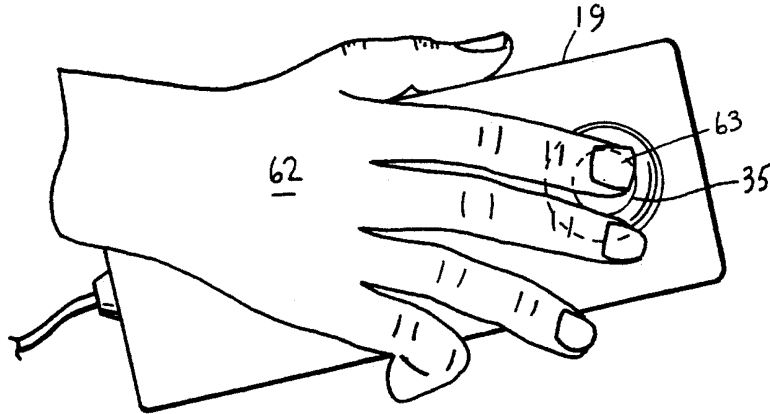


FIG. 4B

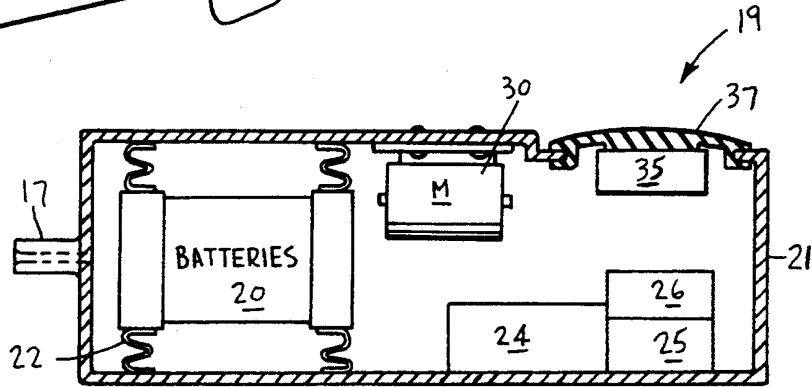


FIG. 5B

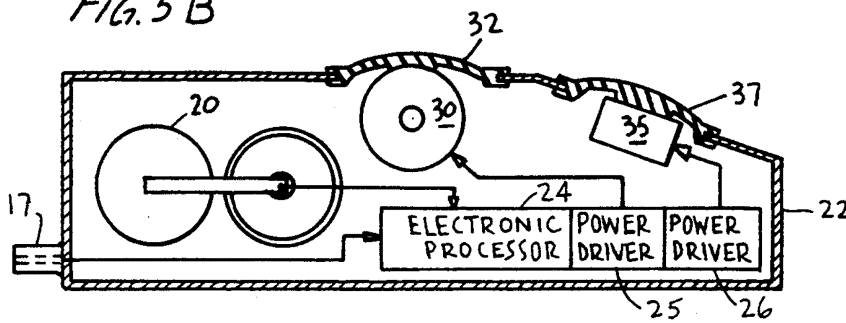
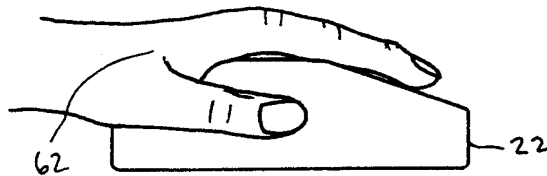


FIG. 5A



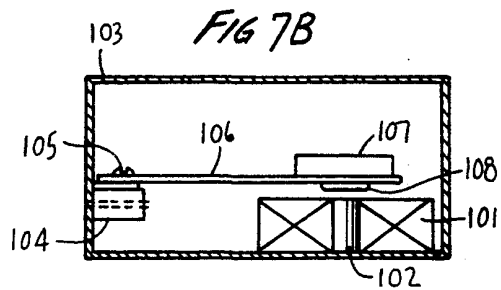
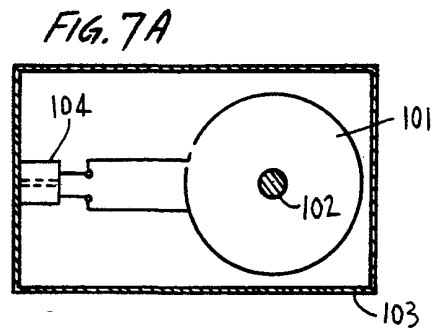
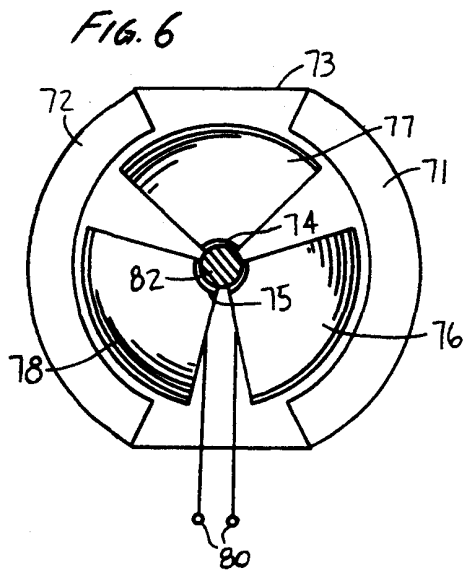


FIG. 8

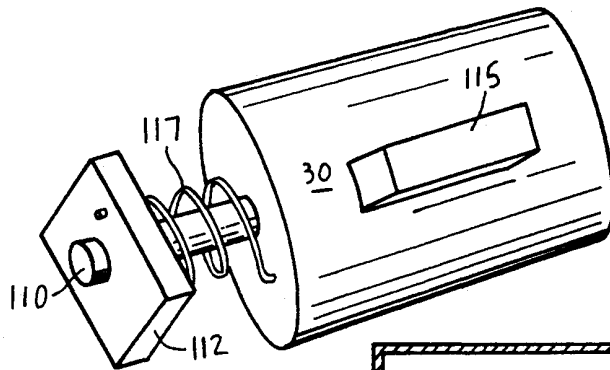


FIG. 9

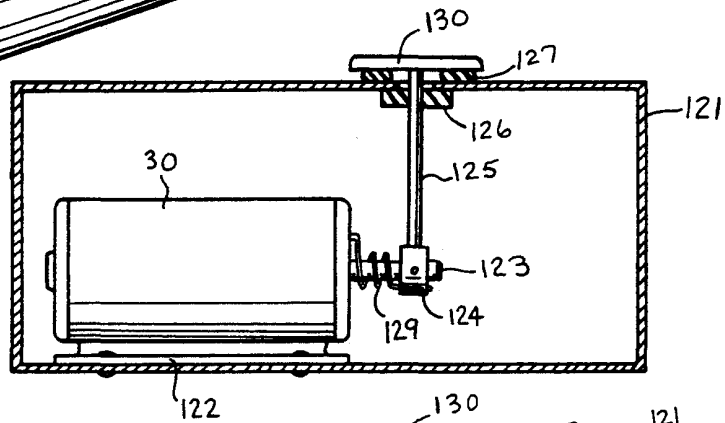


FIG. 10

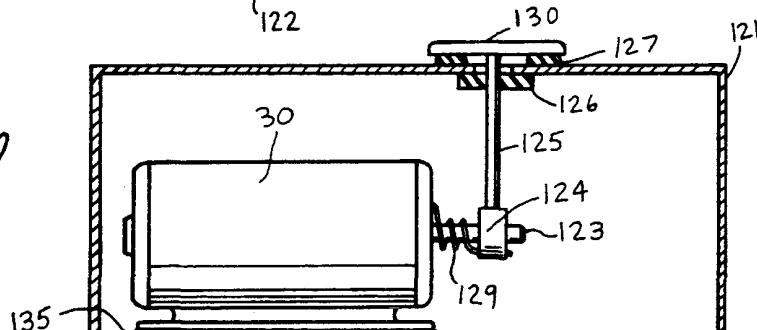


FIG. 11

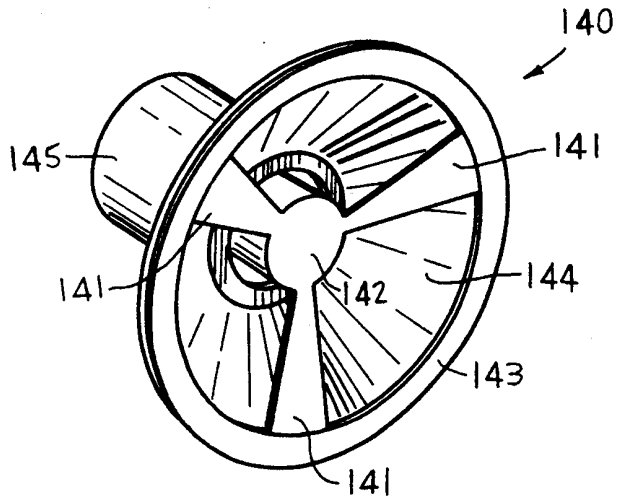


FIG. 12

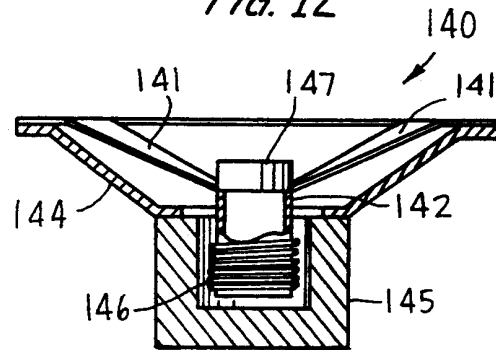
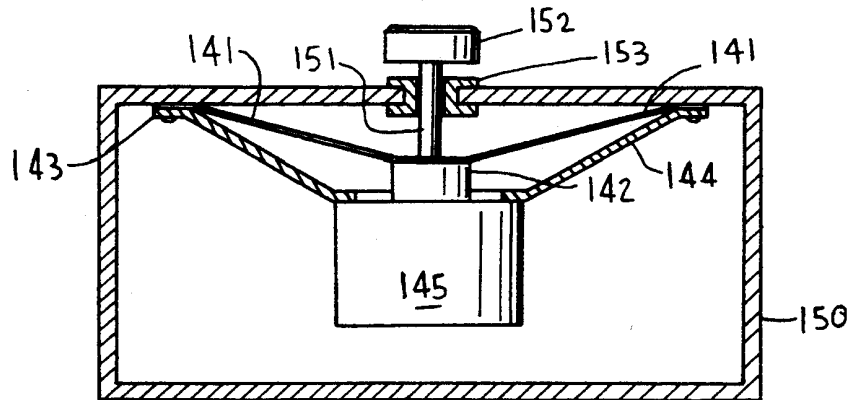


FIG. 13



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