US005304212A

United States Patent [19]

Czeisler et al.

[11] Patent Number: 5,304,212

[45] Date of Patent: Apr. 19, 1994

[54] ASSESSMENT AND MODIFICATION OF A HUMAN SUBJECT'S CIRCADIAN CYCLE

[75] Inventors: Charles A. Czeisler; Richard E. Kronauer, both of Cambridge, Mass.; James S. Allan, Pittsburgh, Pa.

[73] Assignee: Brigham and Women's Hospital, Boston, Mass.

[21] Appl. No.: 819,403

[22] Filed: Jan. 10, 1992

Related U.S. Application Data

[63] Continuation of Ser. No. 521,041, May 9, 1990, Pat. No. 5,167,228, and Ser. No. 365,949, Jun. 15, 1989, Pat. No. 5,176,133, each is a continuation-in-part of Ser. No. 66,677, Jun. 26, 1987, Pat. No. 5,163,426.

[51] Int. Cl.[5] A61N 5/06

[52] U.S. Cl. 607/88

[58] Field of Search 607/88

[56] **References Cited**

U.S. PATENT DOCUMENTS

628,351	7/1899	O'Neill .
720,357	2/1903	Joachimson .
730,750	6/1903	Dowsing .
791,232	5/1905	Wolpers et al. .
828,733	8/1906	Fuller .
853,033	5/1907	Roberts .
1,162,424	11/1915	Wiener .
1,222,945	4/1917	Hammerstein .
1,280,857	10/1918	Ruiter .
1,290,036	1/1919	Anderson .
1,337,798	4/1920	Ruiter .
1,563,736	12/1925	Fink .
1,564,552	12/1925	Gerdes .
1,578,654	3/1926	Gerdes .
1,583,420	5/1926	Picard .
1,718,770	6/1929	Zublin .
1,755,418	4/1930	Anderson .
1,842,100	1/1932	Johnson .
1,859,601	5/1932	Rice .
1,951,569	3/1934	Vestvold .
2,008,653	7/1935	Braselton .
2,054,332	9/1936	Lower et al. .
2,114,173	4/1938	Boerstler .
2,184,644	12/1939	Homberger .
2,444,379	6/1948	Sexton .
2,631,588	3/1953	Paschell .
3,042,046	7/1962	Willems .
3,648,706	3/1972	Holzer .
3,773,049	11/1973	Rabichev et al. .
4,100,415	7/1978	Blaisdell et al. .
4,335,724	6/1982	Frei et al. .
4,424,598	1/1984	Cima .
4,444,189	4/1984	Seiverd .
4,469,102	9/1984	Fish .
4,469,951	9/1984	Coco et al. .
4,543,957	10/1985	Friedman et al. .
4,600,723	7/1986	Short et al. .
4,665,086	5/1987	Short et al. .
4,858,609	8/1989	Cole .
4,911,166	3/1990	Leightor et al. .
4,922,930	5/1990	Adkins et al. .
5,006,985	4/1991	Ehret et al. .
5,079,682	1/1992	Roberts .

FOREIGN PATENT DOCUMENTS

2035088A 6/1980 United Kingdom .

OTHER PUBLICATIONS

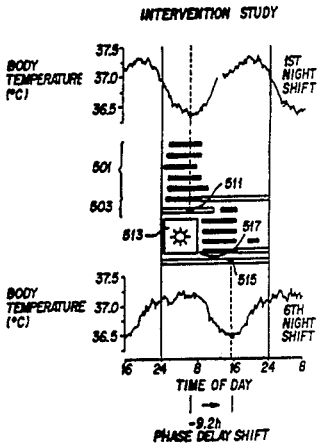
"Mathematical Model of the Human Circadian System With Two Interacting Oscillators," Kronauer et al., *American Journal of Physiology*, vol. 242, 1982, pp. R3–R17.

(List continued on next page.)

Primary Examiner—Ruth S. Smith

Attorney, Agent, or Firm—Sterne, Kessler, Goldstein & Fox

[57] **ABSTRACT**

A method for modifying the human endogenous circadian pacemaker is disclosed. The method comprises the steps of determining the characteristics of a desired endogenous circadian cycle for a subject; selecting an appropriate time with respect to the presumed phase of physiological markers of the present endogenous circadian cycle for the subject during which to apply a light stimulus to effect a desired modification of the present endogenous circadian cycle of the subject; and applying said light stimulus at said selected appropriate time to achieve the desired endogenous circadian cycle for the subject. The method finds special utility in treating "jet lag" sufferers, shift workers, advanced circadian phase experienced by many elderly subjects, and those afflicted with delayed sleep phase insomnia.

39 Claims, 47 Drawing Sheets