Apparatus and method for remotely monitoring and altering brain waves
US 3951134 A

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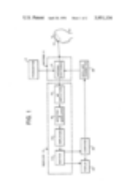
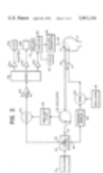
ABSTRACT

Apparatus for and method of sensing brain waves at a position remote from a subject whereby electromagnetic signals of different frequencies are simultaneously transmitted to the brain of the subject in which the signals interfere with one another to yield a waveform which is modulated by the subject's brain waves. The interference waveform which is representative of the brain wave activity is re-transmitted by the brain to a receiver where it is demodulated and amplified. The demodulated waveform is then displayed for visual viewing and routed to a computer for further processing and analysis. The demodulated waveform also can be used to produce a compensating signal which is transmitted back to the brain to effect a desired change in electrical activity therein.

IMAGES (2)





DESCRIPTION

BACKGROUND OF THE INVENTION

Medical science has found brain waves to be a useful barometer of organic functions. Measurements of electrical activity in the brain have been instrumental in detecting physical and psychic disorder, measuring stress, determining sleep patterns, and monitoring body metabolism.

The present art for measurement of brain waves employs electroencephalographs including probes with sensors which are attached to the skull of the subject under study at points proximate to the regions of the brain being monitored. Electrical contact between the sensors and apparatus employed to process the detected brain waves is maintained by a plurality of wires extending from the sensors to the apparatus. The necessity for physically attaching the measuring apparatus to the subject imposes several limitations on the measurement process. The subject may experience discomfort, particulary if the measurements are to be made over extended periods of time. His bodily movements are restricted and he is generally confined to the immediate vicinity of the measuring apparatus. Furthermore, measurements cannot be made while the subject is conscious without his awareness. The comprehensiveness of the measurements is also limited since the finite number of probes employed to monitor local regions of brain wave

CLAIMS (11)

What is claimed is:

1. Brain wave monitoring apparatus comprising

means for producing a base frequency signal,

means for producing a first signal having a frequency related to that of the base frequency and at a predetermined phase related thereto,

means for transmitting both said base frequency and said first signals to the brain of the subject being monitored,

means for receiving a second signal transmitted by the brain of the subject being monitored in response to both said base frequency and said first signals,

mixing means for producing from said base frequency signal and said received second signal a response signal having a frequency related to that of the base frequency, and

means for interpreting said response signal.

activity do not permit observation of the total brain wave profile in a single test.

SUMMARY OF THE INVENTION

The present invention relates to apparatus and a method for monitoring brain waves wherein all components of the apparatus employed are remote from the test subject. More specifically, high frequency transmitters are operated to radiate electromagnetic energy of different frequencies through antennas which are capable of scanning the entire brain of the test subject or any desired region thereof. The signals of different frequencies penetrate the skull of the subject and impinge upon the brain where they mix to yield an interference wave modulated by radiations from the brain's natural electrical activity. The modulated interference wave is re-transmitted by the brain and received by an antenna at a remote station where it is demodulated, and processed to provide a profile of the suject's brain waves. In addition to passively monitoring his brain waves, the subject's neurological processes may be affected by transmitting to his brain, through a transmitter, compensating signals. The latter signals can be derived from the received and processed brain waves.

OBJECTS OF THE INVENTION

It is therefore an object of the invention to remotely monitor electrical activity in the entire brain or selected local regions thereof with a single measurement.

Another object is the monitoring of a subject's brain wave activity through transmission and reception of electromagnetic waves.

Still another object is to monitor brain wave activity from a position remote from the subject.

A further object is to provide a method and apparatus for affecting brain wave activity by transmitting electromagnetic signals thereto.

DESCRIPTION OF THE DRAWINGS

Other and further objects of the invention will appear from the following description and the accompanying drawings, which form part of the instant specification and which are to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in the various views;

FIG. 1 is a block diagram showing the interconnection of the components of the apparatus of the invention;

FIG. 2 is a block diagram showing signal flow in one embodiment of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, specifically FIG. 1, a high frequency transmitter 2 produces and supplies two electromagnetic wave signals through suitable coupling means 14 to an antenna 4. The signals are directed by the antenna 4 to the skull 6 of the subject 8 being examined. The two signals from the antenna 4, which travel independently, penetrate the skull 6 and impinge upon the tissue of the brain 10.

Within the tissue of the brain 10, the signals combine, much in the manner of a conventional mixing process technique, with each section of the brain having a different modulating action. The resulting waveform of the two signals has its greatest amplitude when the two signals are in phase and thus reinforcing one another. When the signals are exactly 180° out of phase the combination

2. Apparatus as in claim 1 where said receiving means comprises

means for isolating the transmitted signals from the received second signals.

3. Apparatus as in claim 2 further comprising a band pass filter with an input connected to said isolating means and an output connected to said mixing means.

4. Apparatus as in claim 1 further comprising means for amplifying said response signal.

5. Apparatus as in claim 4 further comprising means for demodulating said amplified response signal.

6. Apparatus as in claim 5 further comprising interpreting means connected to the output of said demodulator means.

7. Apparatus according to claim 1 further comprising

means for producing an electromagnetic wave control signal dependent on said response signal, and

means for transmitting said control signal to the brain of said subject.

8. Apparatus as in claim 7 wherein said transmitting means comprises means for directing the electromagnetic wave control signal to a predetermined part of the brain.

9. A process for monitoring brain wave activity of a subject comprising the steps of

transmitting at least two electromagnetic energy signals of different frequencies to the brain of the subject being monitored,

receiving an electromagnetic energy signal resulting from the mixing of said two signals in the brain modulated by the brain wave activity and retransmitted by the brain in response to said transmitted energy signals, and,

interpreting said received signal.

10. A process as in claim 9 further comprising the step of transmitting a further electromagnetic wave signal to the brain to vary the brain wave activity.

11. A process as in claim 10 wherein the step of transmitting the further signals comprises

obtaining a standard signal,

comparing said received electromagnetic energy signals with said standard signal,

producing a compensating signal corresponding to the comparison between said received electrogagnetic energy signals and the standard signal, and

transmitting the compensating signals to the brain of the subject being monitored.

produces a resultant waveform of minimum amplitude. If the amplitudes of the two signals transmitted to the subject are maintained at identical levels, the resultant interference waveform, absent influences of external radiation, may be expected to assume zero intensity when maximum interference occurs, the number of such points being equal to the difference in frequencies of the incident signals. However, interference by radiation from electrical activity within the brain 10 causes the waveform resulting from interference of the two transmitted signals to vary from the expected result, i.e., the interference waveform is modulated by the brain waves. It is believed that this is due to the fact that brain waves produce electric charges each of which has a component of electromagnetic radiation associated with it. The electromagnetic radiation produced by the brain waves in turn reacts with the signals transmitted to the brain from the external source.

The modulated interference waveform is re-transmitted from the brain 10, back through the skull 6. A quantity of energy is re-transmitted sufficient to enable it to be picked up by the antenna 4. This can be controlled, within limits, by adjusting the absolute and relative intensities of the signals, originally transmitted to the brain. Of course, the level of the transmitted energy should be kept below that which may be harmful to the subject.

The antenna passes the received signal to a receiver 12 through the antenna electronics 14. Within the receiver the wave is amplified by conventional RF amplifiers 16 and demodulated by conventional detector and modulator electronics 18. The demodulated wave, representing the intra-brain electrical activity, is amplified by amplifiers 20 and the resulting information in electronic form is stored in buffer circuitry 22. From the buffers 22 the information is fed to a suitable visual display 24, for example one employing a cathode ray tube, light emitting diodes, liquid crystals, or a mechanical plotter. The information may also be channeled to a computer 26 for further processing and analysis with the output of the computer displayed by heretofore mentioned suitable means.

In addition to channeling its information to display devices 24, the computer 26 can also produce signals to control an auxiliary transmitter 28. Transmitter 28 is used to produce a compensating signal which is transmitted to the brain 10 of the subject 8 by the antenna 4. In a preferred embodiment of the invention, the compensating signal is derived as a function of the received brain wave signals, although it can be produced separately. The compensating signals affect electrical activity within the brain 10.

Various configurations of suitable apparatus and electronic circuitry may be utilized to form the system generally shown in FIG. 1 and one of the many possible configurations is illustrated in FIG. 2. In the example shown therein, two signals, one of 100 MHz and the other of 210 MHz are transmitted simultaneously and combine in the brain 10 to form a resultant wave of frequency equal to the difference in frequencies of the incident signals, i.e., 110 MHz. The sum of the two incident frequencies is also available, but is discarded in subsequent filtering. The 100 MHz signal is obtained at the output 37 of an RF power divider 34 into which a 100 MHz signal generated by an oscillator 30 is injected. The oscillator 30 is of a conventional type employing either crystals for fixed frequency circuits or a tunable circuit set to oscillate at 100 MHz. It can be a pulse generator, square wave generator or sinusoidal wave generator. The RF power divider can be any conventional VHF, UHF or SHF frequency range device constructed to provide, at each of three outputs, a signal identical in frequency to that applied to its input.

The 210 MHz signal is derived from the same 100 MHz oscillator 30 and RF power divider 34 as the 100 MHz signal, operating in concert with a frequency doubler 36 and 10 MHz oscillator 32. The frequency doubler can be any conventional device which provides at its output a signal with frequency equal to twice the frequency of a signal applied at its input. The 10 MHz oscillator can also be of conventional type similar to the 100 MHz oscillator herebefore described. A 100 MHz signal from the output 39 of the RF power divider 34 is fed through the frequency doubler 36 and the resulting 200 MHz signal is applied to a mixer 40. The mixer 40 can be any conventional VHF, UHF or SHF frequency range device capable of accepting two input signals of differing frequencies and providing two output signals with frequencies equal to the sum and difference in frequencies respectively of the input signals. A 10 MHz signal from the oscillator 32 is also applied to the mixer 40. The 200 MHz signal from the doubler 36 and the 10 MHz signal from the oscillator 32 combine in the mixer 40 to form a signal with a frequency of 210 MHz equal to the sum of the frequencies of the 200 MHz and 10 MHz signals.

The 210 MHz signal is one of the signals transmitted to the brain 10 of the subject being monitored. In the arrangement shown in FIG. 2, an antenna 41 is used to transmit the 210 MHz signal and another antenna 43 is used to transmit the 100 MHz signal. Of course, a single antenna capable of operating at 100 MHz and 210 MHz frequencies may be used to transmit both signals. The scan angle, direction and rate may be controlled mechanically, e.g., by a reversing motor, or electronically, e.g., by energizing elements in the antenna in proper synchronization. Thus, the antenna(s) can be of either fixed or rotary conventional types.

A second 100 MHz signal derived from output terminal 37 of the three-way power divider 34 is applied to a circulator 38 and emerges therefrom with a desired phase shift. The circulator 38 can be of any conventional type wherein a signal applied to an input port emerges from an output port with an appropriate phase shift. The 100 MHz signal is then transmitted to the brain 10 of the subject being monitored via the antenna 43 as the second component of the dual signal transmission. The antenna 43 can be of conventional type similar to antenna 41 herebefore described. As previously noted, these two antennas may be combined in a single unit.

The transmitted 100 and 210 MHz signal components mix within the tissue in the brain 10 and interfere with one another yielding a signal of a frequency of 110 MHz, the difference in frequencies of the two incident components, modulated by electromagnetic emissions from the brain, i.e., the brain wave activity being monitored. This modulated 110 MHz signal is radiated into space.

The 110 MHz signal, modulated by brain wave activity, is picked up by an antenna 45 and channeled back through the circulator 38 where it undergoes an appropriate phase shift. The circulator 38 isolates the transmitted signals from the received signal. Any suitable diplexer or duplexer can be used. The antenna 45 can be of conventional type similar to antennas 41 and 43. It can be combined with them in a single unit or it can be separate. The received modulated 110 MHz signal is then applied to a band pass filter 42, to eliminate undesirable harmonics and extraneous noise, and the filtered 110 MHz signal is inserted into a mixer 44 into which has also been introduced a component of the 100 MHz signal from the source 30 distributed by the RF power divider 34. The filter 42 can be any conventional band pass filter. The mixer 44 may also be of conventional type similar to the mixer 40 herebefore described.

The 100 MHz and 110 MHz signals combine in the mixer 44 to yield a signal of frequency equal to the difference in frequencies of the two component signals, i.e., 10 MHz still modulated by the monitored brain wave activity. The 10 MHz signal is amplified in an IF amplifier 46 and channeled to a demodulator 48. The IF amplifier and demodulator 48 can both be of conventional types. The type of demodulator selected will depend on the characteristics of the signals transmitted to and received from the brain, and the information desired to be obtained. The brain may modulate the amplitude, frequency and/or phase of the interference waveform. Certain of these parameters will be more sensitive to corresponding brain wave characteristics than others. Selection of amplitude, frequency or phase demodulation means is governed by the choice of brain wave characteristic to be monitored. If desired, several different types of demodulators can be provided and used alternately or at the same time.

The demodulated signal which is representative of the monitored brain wave activity is passed through audio amplifiers 50 a, b, c which may be of conventional type where it is amplified and routed to displays 58 a, b, c and a computer 60. The displays 58 a, b, c present the raw brain wave signals from the amplifiers 50 a, b, c. The computer 60 processes the amplified brain wave signals to derive information suitable for viewing, e.g., by suppressing, compressing, or expanding elements thereof, or combining them with other information-bearing signals and presents that information on a display 62. The displays can be conventional ones such as the types herebefore mentioned employing electronic visual displays or mechanical plotters 58b. The computer can also be of conventional type, either analog or digital, or a hybrid.

A profile of the entire brain wave emission pattern may be monitored or select areas of the brain may be observed in a single measurement simply by altering the scan angle and direction of the antennas. There is no physical contact between the subject and the monitoring apparatus. The computer 60 also can determine a compensating waveform for transmission to the brain 10 to alter the natural brain waves in a desired fashion. The closed loop compensating system permits instantaneous and continuous modification of the brain wave response pattern.

In performing the brain wave pattern modification function, the computer 60 can be furnished with an external standard signal from a source 70 representative of brain wave activity associated with a desired nuerological response. The region of the brain responsible for the response is monitored and the received signal, indicative of the brain wave activity therein, is compared with the standard signal. The computer 60 is programmed to determine a compensating signal, responsive to the difference between the standard signal and received signal. The compensating signal, when transmitted to the monitored region of the brain, modulates the natural brain wave activity therein toward a reproduction of the standard signal, thereby changing the neurological response of the subject.

The computer 60 controls an auxiliary transmitter 64 which transmits the compensating signal to the brain 10 of the subject via an antenna 66. The transmitter 64 is of the high frequency type commonly used in radar applications. The antenna 66 can be similar to antennas 41, 43 and 45 and can be combined with them. Through these means, brain wave activity may be altered and deviations from a desired norm may be compensated. Brain waves may be monitored and control signals transmitted to the brain from a remote station.

It is to be noted that the configuration described is one of many possibilities which may be formulated without departing from the spirit of my invention. The transmitters can be monostratic or bistatic. They also can be single, dual, or multiple frequency devices. The transmitted signal can be continuous wave, pulse, FM, or any combination of these as well as other transmission forms. Typical operating frequencies for the transmitters range from 1 MHz to 40 GHz but may be altered to suit the particular function being monitored and the characteristics of the specific subject.

The individual components of the system for monitoring and controlling brain wave activity may be of conventional type commonly employed in radar systems.

Various subassemblies of the brain wave monitoring and control apparatus may be added, substituted or combined. Thus, separate antennas or a single multi-mode antenna may be used for transmission and reception. Additional displays and computers may be added to present and analyze select components of the monitored brain waves.

Modulation of the interference signal retransmitted by the brain may be of amplitude, frequency and/or phase. Appropriate demodulators may be used to decipher the subject's brain activity and select components of his brain waves may be analyzed by computer to determine his mental state and monitor his thought processes.

As will be appreciated by those familiar with the art, apparatus and method of the subject invention has numerous uses. Persons in critical positions such as drivers and pilots can be continuously monitored with provision for activation of an emergency device in the event of human failure. Seizures, sleepiness and dreaming can be detected. Bodily functions such as pulse rate, heartbeat reqularity and others also can be monitored and occurrences of hallucinations can be detected. The system also permits medical diagnoses of patients, inaccessible to physicians, from remote stations.

PATENT CITATIONS

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US3796208 *	Feb 14, 1972	Mar 12, 1974	Memco Ltd	Movement monitoring apparatus

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US5480374 *	Mar 28, 1994	Jan 2, 1996	Van Dick; Robert C.	Method and apparatus for reducing physiological stress
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US8717430	Apr 26, 2010	May 6, 2014	Medtronic Navigation, Inc.	System and method for radio-frequency imaging, registration, and localization
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EP0013183A1 *	Dec 28, 1979	Jul 9, 1980	Erwin Roy John	Electroencephalographic system for the quantitative description of patient brain states

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CLASSIFICATIONS

U.S. Classification	600/544, 600/407
International Classification	A61B5/0476, A61B5/00
Cooperative Classification	A61B5/0006, A61B5/0507, A61B5/0476
European Classification	A61B5/05M, A61B5/00B3B, A61B5/0476

Silent subliminal presentation system

US 5159703 A

ABSTRACT

A silent communications system in which nonaural carriers, in the very low or very high audio frequency range or in the adjacent ultrasonic frequency spectrum, are amplitude or frequency modulated with the desired intelligence and propagated acoustically or vibrationally, for inducement into the brain, typically through the use of loudspeakers, earphones or piezoelectric transducers. The modulated carriers may be transmitted directly in real time or may be conveniently recorded and stored on mechanical, magnetic or optical media for delayed or repeated transmission to the listener.

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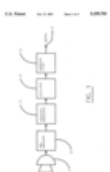
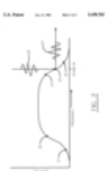
Original Assignee Lowery Oliver M
Export Citation BiBTeX, EndNote, RefMan

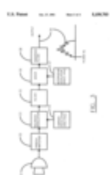
Patent Citations (10), Referenced by (13), Classifications (21), Legal Events (8)

External Links: USPTO, USPTO Assignment, Espacenet

IMAGES (3)







DESCRIPTION

BACKGROUND--FIELD OF THE INVENTION

This invention relates in general to electronic audio signal processing and, in particular, to subliminal presentation techniques.

BACKGROUND--DESCRIPTION OF PRIOR ART

Subliminal learning enjoys wide use today and subliminal tapes are being manufactured by a number of companies in the United States alone. Several decades of scientific study indicate that subliminal messages can influence a human's attitudes and behavior. Subliminal, in these discussions, can be defined as "below the threshold of audibility to the conscious mind." To be effective however, the subliminally transmitted information (called affirmations by those in the profession) must be presented to the listener's ear in such a fashion that they can be perceived and "decoded" by the listener's subconscious mind. We are referring to audio information in this discussion, however, information could be inputted into the subject's subconscious mind through any of the body's sensors, such as touch, smell, sight or hearing. As an example, early development work in the subliminal field utilized motion pictures and slide projections as the medium. Early research into visual and auditory subliminal stimulation effects is exemplified by U.S. Pat. Nos. 3,060,795 of Corrigan, et al. and 3,278,676 of Becker. U.S. Pat. No. 4,395,600 of Lundy and Tyler is representative of later developments in

CLAIMS (3)

What is claimed:

1. A silent communications system, comprising:

(a) amplitude modulated carrier means for generating signals located in non-aural portions of the audio and in the lower portion of the ultrasonic frequency spectrum said signals modulated with information to be perceived by a listener's brain and,

(b) acoustic and ultrasonic transducer means for propagating said signals, for inducement into the brain, of the listener, and,

(c) recording means for storing said modulated signals on mechanical, magnetic and optical media for delayed or repeated transmissions to the listener.

2. A silent communications system, comprising:

(a) frequency modulated carrier means for generating signals located in non-aural portions of the audio and in the lower portion of the ultrasonic frequency spectrum, said signals modulated with information to be perceived by a listener's brain, and;

(b) acoustic and ultrasonic transducer means for propagating said signals, for inducement into the brain of the listener, and;

(c) recording means for storing said modulated signals on mechanical, magnetic and optical media for delayed or repeated transmissions to the listener.

3. A silent communications system, comprising:

(a) a combination of amplitude and frequency modulated carrier means for generating signals located in non-aural portions of the audio and in the lower portion of the ultrasonic frequency spectrum, said signals modulated with information to be perceived by a listener's brain, and

(b) acoustic and ultrasonic transducer means for propagating said signals, for inducement into the brain of the listener;

(c) recording means for storing said modulated signals on mechanical, magnetic and optical media for delayed or repeated transmissions to the listener.

today's subliminal message techniques.

The majority of the audio subliminal tapes available today are prepared using one basic technique. That is, the verbal affirmations are mixed with, and recorded at a lower level than, a "foreground" of music or sounds of ocean surf or a bubbling mountain brook or other similar "masking" sounds. The affirmations are generally recorded 5 decibels (db) or so below the "foreground" programming and regenerative automatic gain control is usually applied to permit the affirmations to change their recorded amplitude in direct proportion to the short term averaged amplitude of the continually varying "foreground" material. In other words, the volume of the affirmations will follow or track the volume changes of the "foreground" programming, but at a lower volume level. Circuit provisions are also usually included to "gate" the affirmations off when the music amplitude is low or zero. This insures that the affirmations cannot be heard during quiet program periods. Thus, today's subliminal affirmations can be characterized as being "masked" by music or other sounds, of constantly changing amplitude and of being reduced or cut off entirely during periods of low or quiet "foreground" programming.

One of the principal, and most widely objected to, deficiencies in available subliminal tape presentation techniques is that the presence of the "foreground" material is intrusive to both the listener and to anyone else in the immediate area. No matter what "foreground" material is chosen, the fact remains that this material can be heard by anyone within its range and presents a definite distraction to other activities such as conversation, thought, desire to listen to other programming such as radio or television, need to concentrate, etc. Additionally, and because the tapes are used repeatedly by the same listener, any "foreground" music or material eventually becomes monotonously tiring to that listener.

It is the purpose of the following described invention to eliminate or greatly reduce all of the above deficiencies. Although its application to the magnetic tape medium is described in the following discussion, the technique is equally applicable to most other desired transmission mediums, such as Compact Disc, videocassettes, digital tape recorders, Public Address (PA) systems, background music installations, computer software programs, random access memory (RAM), read only memory (ROM), "live", real time applications and other mediums now in existence or to be developed in the future.

Implemented on tape cassettes, for example, the subliminal presentation described here is inaudible i.e., high audio or ultrasonic frequencies, the affirmations are presented at a constant, high amplitude level, and they occupy their own "clear channel", non-masked frequency allocations. If desired, the previously described "foreground" music or other material can be added to the tape through use of an audio mixer. The "silent" recordings are inaudible to the user or by others present and are therefore very effective for use during periods of sleep or when in the presence of others. Additionally, the basic requirements of subliminal stimulation are met. That is, the affirmations are efficiently transmitted to the ear and, while undetected by the conscious mind, are perceived by and efficiently decoded by the subconscious mind.

OBJECTS OF THE INVENTION

Accordingly, several objects and advantages of my invention are:

(a) to provide a technique for producing a subliminal presentation which is inaudible to the listeners(s), yet is perceived and demodulated (decoded) by the ear for use by the subconscious mind.

(b) to provide a technique for transmitting inaudible subliminal information to the listener(s) at a constant, high level of signal strength and on a clear band of frequencies.

(c) to provide a technique for producing inaudible subliminal presentations to which music or other "foreground" programming may be added, if desired.

Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, the first digit of each component number also refers to the figure number where that component can be located.

FIG. 1 represents the block diagram of a suitable system which will generate a frequency modulated (FM) signal at 14,500 Hz.

FIG. 2 represents an approximation of the frequency response curve of the human ear and the signal decoding process.

FIG. 3 represents the block diagram of a suitable system which will generate a single sideband, suppressed carrier, amplitude modulated (AM) signal at 14,500 Hz.

______________________________________REFERENCE NUMERALS IN DRAWINGS______________________________________11 microphone or other 14 low distortionaudio input signal audio oscillator12 audio preamplifier 15 high pass or bandif required pass audio filter13 frequency modulation 16 output to tapecircuit recorder or other device21 point on low freq end 25 midpoint on curveresponse curve between points 23 and 2422 point on low freq end 26 speaker output of FIG. 1 toof ear response curve ear23 point on high freq end 27 demodulated subliminalof ear response curve audio inputted to ear24 point on high freq end 31 microphoneof ear response curve32 speech amplifier 33 balanced modulator34 carrier oscillator 35 filter(455 KHz)36 mixer 37 heterodyne oscillator (469.5 KHz)38 bandpass filter 39 output signal______________________________________

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Please refer now to FIG. 1 and FIG. 2, which are drawings of a preferred implementation of the invention.

The principle of operation of the silent subliminal presentation system is as follows:

An audio signal in the upper frequency region of the audio spectrum (for example, 14,500 Hz) is modulated with the desired information. The type of modulation may be any type suitable for subliminal applications; frequency modulation (FM), phase modulation (PM), upper single sideband with suppressed carrier, amplitude modulation (AM), tone modulation, etc.

For broadest application, the high audio frequency selected as the carrier frequency must meet two basic criteria:

(1) be high enough in the audio spectrum that its presence to the human ear is essentially unnoticed or undetectable (without the listener being informed that the signal is actually present) and,

(2) be low enough in the audio spectrum that it (and its modulation content) can produce a useful output power from home entertainment type cassette or reel-to-reel magnetic recorders.

This would also include, of course, small portable and automobile tape decks.

Alternatively, the output of the system can be fed directly into an audio amplifier and its speaker/earphone system, Public Address system, etc.

FIG. 1 provides the block diagram of an example of a system capable of generating the desired silent frequency modulated carrier.

The modulation information is inputted into the microphone 11. Other suitable input devices may be substituted for microphone 11, such as a tape recorder or a radio. The microphone 11 is connected to the preamplifier 12 and should have provisions for adjusting its gain in order that the optimum modulation index can be set in the frequency modulator 13. The frequency modulator 13 modulates the frequency of oscillator 14 which has been adjusted for an output of 14,500 Hz as described above. The output of oscillator 14 is fed through a suitable bandpass filter 15 into the tape recorder or directly into a suitable amplifier/speaker system. It is the purpose of the bandpass filter to remove or attenuate audible products of the modulation process in order to maintain as audibly silent an output as practical.

On the receiving end, FIG. 2 represents an approximate and idealized frequency response curve of the human ear. The frequency modulated carrier (centered at 14,500 Hz), as generated above and played through a tape recorder or amplifier/speaker system, is shown on FIG. 2 as speaker output 26, impinging upon the upper slope of the ear's response curve at point 25. The frequency modulated excursions of the speaker output 26 swing between points 23 and 24 on the ear's upper response curve. Because the response curve between points 23 and 25 is relatively linear, this action results in a relatively linear demodulation of the original modulation intelligence, which is passed on subliminally to the inner ear. The amplitude of the demodulated output is not high enough to be detected by the conscious mind but is sufficient in amplitude to be detected by the subconscious mind. In the field of communications engineering design, the above demodulation process in known as slope detection and was used in early FM receiver design. In those receivers, the response curve was formed by the action of a tuned (inductive/capacitance) circuit. In our case, the response curve is formed by the natural response curve of the human ear. The same slope detection technique can be performed at the low frequency end of the human ear response curve. This region is indicated on FIG. 2 as between points 21 and 22. This region, however, has a much smaller available bandwidth and is therefore more restricted as to the amount of information that can be transmitted in an inaudible manner.

In practice, the listener adjusts the volume control of the tape recorder or amplifier to a level just below that at which the listener hears an audible sound or noise from the speaker of the tape recorder. If the recording process is properly done, a spectrum analyzer or a calibrated sound level meter will reveal a strong signal emanating from the tape recorder speaker. A calibrated sound level meter, at a distance of 1 meter (with C weighting and referenced to the standard of 0.0002 micro bar) will typically indicate a silent power output of from 60 to 70 decibels. This is equivalent to the audio power of a loud conversation, yet, in the described system, is inaudible or unnoticed by the listener.

FIG. 3 illustrates a system which generates a suitable amplitude modulated (AM) signal, instead of the frequency modulated (FM) system described above. The output is a modulated, single sideband (SSB), suppressed carrier (AM) signal at 14,500 Hz.

The block diagram represents a common scheme for generating an SSB signal and will be briefly described.

The desired subliminal information is spoken into microphone 31. This signal is amplified by speech amplifier 32 and injected into one port of balanced modulator 33. A continuous wave signal of 455 KHz is generated by carrier oscillator 34 and is injected into the second port of balanced modulator 33. The output of balanced modulator 33 is a double sideband, suppressed carrier signal at 455 KHz. This signal is fed through filter 35, causing one of the two sidebands to be removed. This signal is fed into one port of mixer 36. A continuous wave signal at a frequency of 469.5 KHz from hetrodyne oscillator 37 is fed into the other port of mixer 36, resulting in an output of the original subliminal audio information but translated 14,500 Hz higher in frequency. The bandpass filter 38 attenuates signals and noise outside of the frequencies of interest. The amplitude modulated audio output signal is shown as output 39.

Thus, as stated earlier, my invention provides a new system for subliminal presentations which is:

(a) silent,

(b) outputs a constant, high level modulated signal and,

(c) occupies a band of clear channel frequencies.

The foregoing description of the preferred embodiment of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above discussions. It is intended that the scope of the invention be limited not only by this detailed description, but rather by the claims appended hereto.

PATENT CITATIONS

Cited Patent	Filing date	Publication date	Applicant	Title
US3060795 *	May 7, 1958	Oct 30, 1962	Precon Process And Equipment C	Apparatus for producing visual stimulation
US3278676 *	Oct 29, 1962	Oct 11, 1966	Precon Process And Equipment C	Apparatus for producing visual and auditory stimulation
US3393279 *	Mar 13, 1962	Jul 16, 1968	Listening Inc	Nervous system excitation device
US3712292 *	Jul 20, 1971	Jan 23, 1973	Karen Lafley V	Method and apparatus for producing swept frequency-modulated audio signal patterns for inducing sleep
US4141344 *	Mar 2, 1978	Feb 27, 1979	Barbara Louis J	Sound recording system
US4395600 *	Nov 26, 1980	Jul 26, 1983	Lundy Rene R	Auditory subliminal message system and method
US4463392 *	Apr 13, 1981	Jul 31, 1984	Fisher Charles B	Recording system with noise reduction
US4777529 *	Jul 21, 1987	Oct 11, 1988	R. M. Schultz & Associates, Inc.	Auditory subliminal programming system
US4834701 *	Jul 24, 1985	May 30, 1989	Ken Hayashibara	Apparatus for inducing frequency reduction in brain wave

US4877027 *	Jun 6, 1988	Oct 31, 1989	Brunkan Wayne B	Hearing system

* Cited by examiner

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Citing Patent	Filing date	Publication date	Applicant	Title
US5539705 *	Oct 27, 1994	Jul 23, 1996	Martin Marietta Energy Systems, Inc.	Ultrasonic speech translator and communications system
US5561689 *	Oct 26, 1994	Oct 1, 1996	International Business Machines Corporation	Method and apparatus for digital carrier detection in a wireless lan
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US6678381 *	Nov 23, 1998	Jan 13, 2004	Nec Corporation	Ultra-directional speaker
US6807281 *	Dec 28, 1998	Oct 19, 2004	Sony Corporation	Loudspeaker and method of driving the same as well as audio signal transmitting/receiving apparatus
US7502481	Aug 31, 2004	Mar 10, 2009	Microsoft Corporation	Microphone with ultrasound/audible mixing chamber to secure audio path
US7580762 *	Nov 18, 2004	Aug 25, 2009	Microsoft Corporation	Microphone with ultrasound/audible mixing chamber to secure audio path
US7801315 *	Dec 17, 2004	Sep 21, 2010	Citizen Holdings Co., Ltd.	Method and device for driving a directional speaker
US8666526 *	Jul 9, 2009	Mar 4, 2014	Seiko Epson Corporation	Transmission device, transmission system, transmission method, and computer program product for synthesizing and transmitting audio to a reproduction device
US20100026911 *	Jul 9, 2009	Feb 4, 2010	Seiko Epson Corporation	Transmission device, transmission system, transmission method, and computer program product
DE102012009060A1 *	May 9, 2012	Nov 14, 2013	Christel Kurig	Method for influencing subconscious mind through audio suggestion for changing acquired behavior of user, involves inputting information tailored to changing behavior in acoustic device, and converting information into acoustic information
WO2004017278A1 *	Dec 4, 2002	Feb 26, 2004	Level Developers Llc	Process and apparatus for facilitating the memorizing of sounds and/or words
WO2006086743A2 *	Feb 9, 2006	Aug 17, 2006	American Tech Corp	In-band parametric sound generation system

* Cited by examiner

CLASSIFICATIONS

U.S. Classification	455/42, G9B/20.009, 607/56, 455/46, 455/67.11, 381/73.1, G9B/20.004, 455/67.16, 455/67.13
International Classification	H04R27/00, G11B20/10, H04B14/00, G11B20/02
Cooperative Classification	H04R27/00, G11B20/10, G11B20/02, H04B14/002
European Classification	G11B20/02, H04R27/00, H04B14/00B, G11B20/10

LEGAL EVENTS

Date	Code	Event	Description
Mar 9, 1993	PA	Patent available for license or sale	

Jan 11, 1996	FPAY	Fee payment	**Year of fee payment:** 4
May 23, 2000	REMI	Maintenance fee reminder mailed	
Jun 12, 2000	SULP	Surcharge for late payment	
Jun 12, 2000	FPAY	Fee payment	**Year of fee payment:** 8
May 12, 2004	REMI	Maintenance fee reminder mailed	
Oct 27, 2004	LAPS	Lapse for failure to pay maintenance fees	
Dec 21, 2004	FP	Expired due to failure to pay maintenance fee	**Effective date:** 20041027

Method and apparatus for producing subliminal images

US 5017143 A

Publication number	US5017143 A
Publication type	Grant
Application number	US 07/333,423
Publication date	May 21, 1991
Filing date	Apr 4, 1989
Priority date	Apr 4, 1989
Fee status	Lapsed
Inventors	Alan Backus, Ronald Popeil
Original Assignee	Popeil Industries, Inc.
Export Citation	BiBTeX, EndNote, RefMan

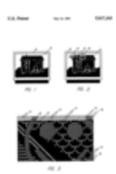
Patent Citations (4), Referenced by (24), Classifications (7), Legal Events (8)

External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

A method and apparatus to produce more effective visual subliminal communications. Graphic and/or text images, presented for durations of less than a video frame, at organized rhythmic intervals, the rhythmic intervals intended to affect user receptivity, moods or behavior. Subliminal graphic images having translucent visual values locally dependent on background values in order to maintain desired levels of visual contrast.

IMAGES (1)



DESCRIPTION

BACKGROUND

1. Field of Invention

The field of this invention is the production and generation of visual subliminal images, and in particular, video subliminal images intended to alter behavior, attitudes, moods and/or performance.

2. Description of Prior Art

Video subliminal image generation products are popular and widely available. Subliminal herein refers to signals which are measurably present but below the level of human conscious perception. The video subliminal images are intended to aid viewers in: losing weight, reducing smoking, gaining self-confidence and much more.

Typical of such products are VCR tapes which may contain subliminal video and subliminal audio messages presented simultaneously against a backdrop of conventional clearly perceptible (i.e., supraliminal) scenes and sound tracks.

Typical clearly perceptible scenes and sound tracks on VCR self-help tapes include: a beach at sundown with crashing wave sounds, a sky full of clouds accompanied by the noise of wind rushing through pines, flowers bobbing in the wind backed with new-age music, etc.

CLAIMS (5)

We claim:

1. A method of producing subliminal images comprising the steps of:

forming a subliminal raster image for video display for less than a full raster refresh cycle, and said image having a plurality of rasters missing from an otherwise complete image.

2. The method of claim 1 wherein said plurality of rasters missing includes substantially all rasters corresponding to a single raster field.

3. A method of producing subliminal images comprising the steps of:

forming a subliminal raster image for a cathode ray tube device for less than a full raster refresh cycle, and said image having a plurality of rasters missing from an otherwise complete image.

4. The method of claim 3 wherein said plurality of rasters missing includes substantially all rasters corresponding to a single raster field.

5. A method of producing visual subliminal communications comprising presenting a plurality of subliminal visual communication messages serially, each said communication message being dependent on the rest to convey an intended message, and said plurality of subliminal visual communication messages presented serially being graphic images with variations between proximate

Against these scenes, video subliminal messages are flashed or faded about once every 1 to 30 seconds. Subliminal messages are presented for durations ranging from a single television frame (1/30 of a second U.S. NTSC standard), to a up to about 5 seconds.

images which represent perceived movement.

As presently known, these subliminal messages are composed solely of text presented at very faint levels. This text may appear as solid or airbrushed outlined letters and may contain from one to over five words.

Accompanying this text are generally subliminal verbal messages which are masked by the conventional clearly perceptible sound tracks they accompany.

These video self-help tapes have several disadvantages. First, the relatively long duration their text messages appear on a television screen (1/30 second or longer) means the messages must be presented at very faint visual contrast levels to remain subliminal. The human eye can clearly perceive a single television frame at 1/30 of a second, so making these messages have low contrast with their backgrounds is the only means to make them truly subliminal.

Hiding these subliminal text messages is complicated by their clearly perceptible backgrounds having many visual values which regularly change. To compensate for this, many of these tapes show scenes with broad areas of near uniform visual values and present their subliminal images using translucent text of a single intensity. Such tapes make no effort to locally adjust the values of their visual subliminal messages according to the backgrounds they are presented against. To simplify tape production still further, these tapes also keep such scenes on television screens for long durations.

Next, the relatively long durations these subliminal text messages appear on a television screen limits the number of messages which may be shown within a given period of time. By taking one or many full television frames to display a message, these systems limit the amount of information they can convey.

Next, the relatively long durations these subliminal text messages appear on television screens limits the frequencies at which such messages may be shown. This in turn limits the visual rhythms such messages may be shown at. Visual rhythms, like those created by strobe lights or rapidly changing movie scenes, have been shown to have a strong influence on human receptivity, moods and behavior. Current tapes make no attempt to use the rhythms at which they present their visual subliminal messages as a means of affecting user receptivity, moods or behavior. There are indications such subliminal visual rhythms may be used, among other things, to relax a user to be more receptive to subliminal visual and audio messages, and to alter viewer moods. Such organized subliminal visual rhythms may also be coordinated with organized rhythms in accompanying subliminal audio messages as well as with organized rhythms in accompanying clearly perceptible scenes and sound tracks to enhance the tapes' effects.

Finally, as indicated, the messages contained on today's self-help subliminal video tapes use only text to convey their messages. Text messages rely on a viewer's reading ability and are easily subject to misinterpretation. An example of such misinterpretation might be the message "less food is good" being quickly misread as "food is good" thus encouraging a viewer to eat instead of curbing excessive consumption. Such misinterpretation is exacerbated by the lack of visual obviousness inherent in video subliminal messages. The human mind interprets meaning from graphic images more quickly and fundamentally than from written words. None of today's self-help video tapes are understood to use graphic subliminal images to convey their messages.

SUMMARY OF THE INVENTION

The present invention is directed to a method and apparatus for producing more effective visual subliminal images. To that end, graphic and/or text images may be presented during a single video frame refresh, at organized rhythmic intervals intended to affect user receptivity, moods or behavior. Such images may have translucent or opaque visual values that are locally dependent on local background values in order to maintain desired levels of visual contrast.

Objects and Advantages

Accordingly, it is an object of the present invention to display visual subliminal images which convey information quickly and unambiguously.

A further object is to present visual subliminal images which are not dependent on the literacy or reading ability of a viewer.

A further object is to increase the number of visual subliminal messages which may be shown a viewer within a given period of time.

A further object is to increase the effectiveness of visual subliminal messages by organizing their presentation rhythms to alter viewer moods or behavior, or enhance viewer receptivity.

A further object is to increase the variety of scenes which may be used as effective backgrounds for visual subliminal messages.

A further object is to increase allowable visual contrast of subliminal messages with their backgrounds by reducing subliminal message appearance time.

Readers will find further objects and advantages of the invention from a consideration of the ensuing description of the preferred embodiment and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic representation of a television displaying a conventional clearly perceptible television image.

FIG. 2 is a diagrammatic representation of the television and clearly perceptible television image of FIG. 1 with the preferred embodiment's subliminal images overlaying the clearly perceptible television image.

FIG. 3 is a diagrammatic representation of an enlarged portion of FIG. 2's television image.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The following description of the preferred embodiment is made with reference to the following drawing reference numerals:

22 television set

22 clearly perceptible television image

24 subliminal image--"x" out burning cigarette

26 subliminal image--"=" sign

28 subliminal image--happy face

30 horizontal raster boundaries

32 rasters generated in first image interlace

34 rasters generated in second image interlace

36 rasters blanked from "happy face" subliminal image

38 translucent dark rasters present in "happy face"subliminal image appearing against a light clearly perceptible background

40 rasters blanked from "happy face" subliminal image

42 translucent light rasters present in "happy face"subliminal image appearing against a dark clearly perceptible background

Referring to FIG. 1 and FIG. 2, the subliminal images generated by the present invention's preferred embodiment are intermittently overlaid on a conventional clearly perceptible NTSC television image.

The preferred embodiment's subliminal images, such as the ones shown in FIGS. 2 and 3, are intermittently presented. Intervals between subliminal images may range from no time, where different images are presented in directly adjacent frames or fields, up to several seconds or longer.

Each subliminal image or subliminal image combination (like the 3 images shown in FIGS. 2 and 3) is displayed within the interval of one video frame refresh (in the case of NTSC, within 1/30 second).

The preferred embodiment's subliminal images 24 26 28 are overlaid on a clearly perceptible television image 22 with the subliminal images having a plurality of missing rasters 36 40. In the case of NTSC standard images, every second raster 36 40 is missing from the subliminal images. This leaves subliminal images comprised of rasters on alternating horizontal scan lines 38 42. Some of these alternate subliminal image rasters may be blanked as well to make the image less perceptible where detail isn't required in the subliminal image.

Because each NTSC video frame is composed of 2 interlaced video fields, the preferred embodiment's subliminal image appears only in one video frame interlace, or for a duration of a 1/60 of a second video field. This is near the limit of conscious human ocular perception.

This short viewing duration means the preferred embodiment's subliminal images may be more visually obvious (i.e. have higher contrast with their backgrounds) during their short appearance than subliminal images seen for longer durations.

It also allows more subliminal images to be presented during any given period of time, when compared to subliminal images presented for longer durations.

Finally short presentation periods permit the subliminal images to be presented using a wide variety of organized presentation rhythms. These rhythms may be arranged to relax the viewer and make the viewer more receptive to the content of the subliminal messages or alter viewer moods or behaviors.

The preferred embodiment's subliminal images may locally vary in visual values depending on the local visual values of the clearly perceptible backgrounds against which they appear. This can mean that as a clearly perceptible background locally changes within a video frame from being dark gray to black, that the subliminal images overlaying the background will locally change from a translucent light gray to a translucent dark gray.

This can also mean that as a clearly perceptible background within a video frame locally changes from black to white, that the subliminal images overlaying the background may locally change from being translucently lighter than the image 42 to being translucently darker than the image 38. This is done to maintain the subliminal images at a desired level of visual contrast regardless of the local values of the clearly perceptible backgrounds against which the subliminal images appear.

The subliminal images may contain text in addition to, or in place of, the graphic communications images illustrated in FIGS. 2 and 3.

Also, one or a combination of images may be shown over an entire television screen, or in any portion thereof.

There are several ways to produce the preferred embodiment's subliminal images. One of these is to use a video editing studio. Here a tape containing the clearly perceptible images 22 to be used as background for the preferred embodiment's subliminal images 24 26 28 is modified using video animation equipment to isolate each video frame. An artist using a video frame editor adds the preferred embodiment's subliminal images 24 26 28 to each selected frame. Once all the subliminal messages are added, the master tape is duplicated to other VCR tapes.

Home or business users may then play the duplicate tapes back on VCRs for television viewing of both the clearly perceptible and subliminal images.

Many variations of this preferred embodiment may easily be envisioned by someone skilled in the art. As examples:

Any combination of features from the above could be used without others being present.

Instead of using a VCR tape duplicated from a studio master, other media could be used.

Also, the subliminal and background images could emanate locally from separate sources while in use. This would mean using a local video image combiner and possibly electronically monitoring the local visual values of the background images to determine the local subliminal image contrast values.

The subliminal images could have chroma and use color and/or color saturation to generate local frame contrast.

The subliminal image could be presented on raster systems having more than two interlaced fields per video frame. In this case, subliminal image rasters would be omitted which represented one or more refresh fields.

Successive identical subliminal images could be shown with only image shift being used to keep them from becoming perceptible through overlap.

Subliminal images could be animated by presenting changing subliminal images representing movement in adjoining or closely proximate video frames or fields. Each such animated frame could have some or all of the preferred embodiment's features.

Subliminal messages could be presented serially like the old Berma Shave road signs. Here individual frames would present words, phrases or graphic symbols which only make sense when linked together. An example of this is two proximate subliminal messages, the first saying "THIN" and the second saying "IS HEALTHY".

Also, the same subliminal message could be repeated several times within the sam video frame.

While embodiments and applications of this invention have been shown and described, it would be apparent to those skilled in the art that many more modifications are possible without departure from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the appended claims.

PATENT CITATIONS

Cited Patent	Filing date	Publication date	Applicant	Title
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US3782006 *	May 26, 1972	Jan 1, 1974	American Clinic Inc	Means and methods to assist people in building up an aversion to undesirable habits
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US4717343 *	Jun 30, 1986	Jan 5, 1988	Densky Alan B	Method of changing a person's behavior

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US5265202 *	Aug 28, 1992	Nov 23, 1993	International Business Machines Corporation	Method and system for accessing visually obscured data in a data processing system
US5270800 *	Aug 28, 1990	Dec 14, 1993	Sweet Robert L	Subliminal message generator
US5418576 *	Sep 19, 1994	May 23, 1995	U. S. Philips Corporation	Television receiver with perceived contrast reduction in a predetermined area of a picture where text is superimposed
US5430495 *	Jan 7, 1993	Jul 4, 1995	Samsung Electronics Co., Ltd.	Video playback apparatus capable of varying caption brightness based on audio level
US5523791 *	Oct 12, 1993	Jun 4, 1996	Berman; John L.	Method and apparatus for applying overlay images
US5581243 *	Jun 4, 1990	Dec 3, 1996	Microslate Inc.	Method and apparatus for displaying simulated keyboards on touch-sensitive displays
US5764229 *	May 9, 1996	Jun 9, 1998	International Business Machines Corporation	Method of and system for updating dynamic translucent windows with buffers
US5793364 *	Jun 14, 1996	Aug 11, 1998	Entertainment Drive, L.L.C.	Method and system for associating playback of multiple audiovisual programs with one graphic interface element
US5805237 *	Oct 8, 1993	Sep 8, 1998	Canon Kabushiki Kaisha	Image processing apparatus with a function of superimposing a binary image on another image
US5827071 *	Aug 26, 1996	Oct 27, 1998	Sorensen; Steven Michael	Method, computer program product, and system for teaching or reinforcing information without requiring user initiation of a learning sequence
US6108142 *	Nov 4, 1998	Aug 22, 2000	Disney Enterprises, Inc.	System for displaying a phosphorescent image and method therefor
US6118427 *	Apr 18, 1996	Sep 12, 2000	Silicon Graphics, Inc.	Graphical user interface with optimal transparency thresholds for maximizing user performance and system efficiency
US6317128	Nov 25, 1997	Nov 13, 2001	Silicon Graphics, Inc.	Graphical user interface with anti-interference outlines for enhanced variably-transparent applications
US6359657 *	May 2, 1997	Mar 19, 2002	U.S. Philips Corporation	Simultaneously displaying a graphic image and video image
US6654067	Dec 30, 1999	Nov 25, 2003	Koninklijke Philips Electronics N.V.	Finding hidden images in video based on detected proximity of cuts
US6769918	Jun 22, 1998	Aug 3, 2004	Goed Heinz	Tutorial system for learning training contents, learning programme logic
			Rockwell Electronic	

US6885744	Dec 20, 2001	Apr 26, 2005	Commerce Technologies, Llc	Method of providing background and video patterns
US20120001748 *	Jun 30, 2010	Jan 5, 2012	Norman Ladouceur	Methods and apparatus for visually supplementing a graphical user interface
US20130216204 *	Sep 21, 2010	Aug 22, 2013	Echostar Ukraine L.L.C.	Subliminal frame insertion
DE4340844C1 *	Nov 26, 1993	Mar 2, 1995	Lutz Mehlhorn	Method and device for insertion of information for subliminal perception
WO1994026063A1 *	May 3, 1994	Nov 10, 1994	Pinjaroo Pty Limited	Subliminal message display system
WO1995015056A1 *	Nov 23, 1994	Jun 1, 1995	Lutz Mehlhorn	Process and device for inlaying in information for subliminal perception
WO1997037712A1 *	Mar 27, 1997	Oct 16, 1997	Vitaliano Silingardi	System and device for producing and transmitting subliminal messages
WO2002086850A1 *	Apr 19, 2002	Oct 31, 2002	Macinnes Carl John	Movement suggestion and motivation methods and related means

* Cited by examiner

CLASSIFICATIONS

U.S. Classification	434/236, 348/586, 348/564, 434/307.00R
International Classification	G09B19/00
Cooperative Classification	G09B19/00
European Classification	G09B19/00

LEGAL EVENTS

Date	Code	Event	Description
Jun 22, 1989	AS	Assignment	**Owner name:** POPEIL INDUSTRIES, INC., CALIFORNIA **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST.;ASSIGNORS:BACKUS, ALAN;POPEIL, RONALD;REEL/FRAME:005208/0193 **Effective date:** 19890616
Sep 26, 1994	FPAY	Fee payment	**Year of fee payment:** 4
Oct 30, 1998	FPAY	Fee payment	**Year of fee payment:** 8
Mar 30, 2000	AS	Assignment	**Owner name:** ADVANTAGE PARTNERS LLC, CALIFORNIA **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:BACKUS, ALAN L.;POPEIL, RONALD M.;REEL/FRAME:010710/0528 **Effective date:** 19991230 **Owner name:** ADVANTAGE PARTNERS LLC 4435 ENCINAS LA CANADA CALI **Owner name:** ADVANTAGE PARTNERS LLC 4435 ENCINAS LA CANADA CALI **Free format text:** ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNORS:BACKUS, ALAN L.;POPEIL, RONALD M.;REEL/FRAME:010710/0528 **Effective date:** 19991230
Dec 4, 2002	REMI	Maintenance fee reminder mailed	
May 21, 2003	LAPS	Lapse for failure to pay maintenance fees	
Jul 15, 2003	FP	Expired due to failure to pay maintenance fee	**Effective date:** 20030521
			Owner name: RONCO ACQUISITION CORPORATION, CALIFORNIA **Free format text:** ASSET PURCHASE AGREEMENT;ASSIGNORS:RONCO CORPORATION;RONCO MARKETING CORPORATION;REEL/FRAME:020679/0917 **Effective date:** 20070713 **Owner name:** RONCO ACQUISITION CORPORATION,CALIFORNIA **Free format text:** ASSET PURCHASE AGREEMENT;ASSIGNORS:RONCO

			CORPORATION;RONCO MARKETING CORPORATION;REEL/FRAME:20679/917
Mar 19, 2008	AS	Assignment	**Owner name:** RONCO ACQUISITION CORPORATION,CALIFORNIA **Free format text:** ASSET PURCHASE AGREEMENT;ASSIGNORS:RONCO CORPORATION;RONCO MARKETING CORPORATION;REEL/FRAME:20679/917 **Effective date:** 20070713 **Owner name:** RONCO ACQUISITION CORPORATION,CALIFORNIA **Free format text:** ASSET PURCHASE AGREEMENT;ASSIGNORS:RONCO CORPORATION;RONCO MARKETING CORPORATION;REEL/FRAME:020679/0917 **Effective date:** 20070713

Hearing system

US 4877027 A

Publication number	US4877027 A
Publication type	Grant
Application number	US 07/202,679
Publication date	Oct 31, 1989
Filing date	Jun 6, 1988
Priority date	Jun 6, 1988
Fee status	Paid
Inventors	Wayne B. Brunkan
Original Assignee	Brunkan Wayne B
Export Citation	BiBTeX, EndNote, RefMan

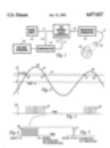
Patent Citations (2), Non-Patent Citations (8), Referenced by (4), Classifications (4), Legal Events (8)

External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

Sound is induced in the head of a person by radiating the head with microwaves in the range of 100 megahertz to 10,000 megahertz that are modulated with a particular waveform. The waveform consists of frequency modulated bursts. Each burst is made up of ten to twenty uniformly spaced pulses grouped tightly together. The burst width is between 500 nanoseconds and 100 microseconds. The pulse width is in the range of 10 nanoseconds to 1 microsecond. The bursts are frequency modulated by the audio input to create the sensation of hearing in the person whose head is irradiated.

IMAGES (1)



DESCRIPTION

This invention relates to a hearing system for human beings in which high frequency electromagnetic energy is projected through the air to the head of a human being and the electromagnetic energy is modulated to create signals that can be discerned by the human being regardless of the hearing ability of the person.

THE PRIOR ART

Various types of apparatus and modes of application have been proposed and tried to inject intelligible sounds into the heads of human beings. Some of these have been devised to simulate speech and other sounds in deaf persons and other systems have been used to inject intelligible signals in persons of good hearing, but bypassing the normal human hearing organs.

U.S. Pat. No. 3,629,521 issued Dec. 21, 1971 describes the use of a pair of electrodes applied to a person's head to inject speech into the head of a deaf person. An oscillator creates a carrier in the range of 18 to 36 KHz that is amplitude modulated by a microphone.

Science magazine volume 181, page 356 describes a hearing system utilizing a radio frequency carrier of 1.245 GHz delivered through the air by means of a waveguide and horn antenna. The carrier was pulsed at the rate of 50 pulses per second. The human test subject reported a buzzing sound and the intensity varied

CLAIMS (8)

I claim:

1. Apparatus for creating human hearing comprising:

(a) an audio source for creating electrical audio waves having positive peaks;

(b) a frequency modulator generator connected to the audio source to create frequency modulated bursts;

(c) a source of constant voltage to create a voltage standard that is in the range of 25% to 85% of the peak voltage of the audio waves;

(d) a comparator connected to the voltage source and the audio source to compare the instantaneous voltage of the waves from the audio source with the voltage standard;

(e) a connection of the comparator to the frequency modulator generator to activate the frequency modulator generator when the instantaneous voltage of the audio wave exceeds the standard voltage;

(f) a microwave generator creating microwaves in the range of 100 megahertz to 10,000 megahertz and connected to the frequency modulator generator, generating microwaves only when pulsed by the frequency modulator generator; and with the peak power.

Similar methods of creating "clicks" inside the human head are reported in I.E.E.E. Transactions of Biomedical Engineering, volume BME 25, No. 3, May 1978.

The transmission of intelligible speech by audio modulated Microwave is described in the book Microwave Auditory Effects and Applications by James C. Lin 1978 publisher Charles C. Thomas.

BRIEF SUMMARY OF THE INVENTION

I have discovered that a pulsed signal on a radio frequency carrier of about 1,000 megahertz (1000 MHz) is effective in creating intelligible signals inside the head of a person if this electromagnetic (EM) energy is projected through the air to the head of the person. Intelligible signals are applied to the carrier by microphone or other audio source and I cause the bursts to be frequency modulated. The bursts are composed of a group of pulses. The pulses are carefully selected for peak strength and pulse width. Various objects, advantages and features of the invention will be apparent in the specification and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings forming an integral part of this specification:

FIG. 1 is a block diagram of the system of the invention.

FIG. 2 is a diagram of an audio wave which is the input to be perceived by the recipient.

FIG. 3 is a diagram on the same time coordinate as FIG. 2 showing bursts that are frequency modulated by the wave form of FIG. 2.

FIG. 4 shows, on an enlarged time coordinate, that each vertical line depicted in FIG. 3 is a burst of pulses. (A burst is a group of pulses).

FIG. 5 shows, on a further enlarged time coordinate, a single continues pulse, Depicted as a vertical line in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

Inasmuch as microwaves can damage human tissue, any projected energy must be carefully regulated to stay within safe limits. The guideline for 1,000 MHz, set by the American Standards Institute, is 3.3 mw/cm2 (3.3 milliwatts per square centimeter). The apparatus described herein must be regulated to stay within this upper limit.

Referring to FIG. 1 a microphone 10 or other generator of audio frequencies, delivers its output by wire 11 to an FM capable pulse generator 12 and by branch wire 13 to a comparator 14. The comparator 14 also receives a signal from a voltage standard 16. When the peak voltage of the audio generator 10 falls below the standard 16 the comparator delivers a signal by wire 17 to the FM capable pulse generator 12 to shut down the pulse generator 12. This avoids spurious signals being generated. The output of the FM pulse generator 12 is delivered by wire 18 to a microwave generator 19 which delivers its output to the head of a human being 23. In this fashion the person 23 is radiated with microwaves that are in short bursts.

The microwave generator 19 operates at a steady frequency presently preferred at 1,000 megahertz (1,000 million). I presently prefer to pulse the microwave energy at pulse widths of 10 nanoseconds to 1 microsecond. For any one setting of the FM capable generator 12, this width is fixed. The pulses are arranged in bursts. The timing between bursts is controlled by the height of the audio envelope above the voltage standard line. In addition the bursts are spaced from one another at a

(g) an antenna connected to the microwave generator to radiate the head of a human being to produce the sounds of the audio source.

2. Apparatus as set forth in claim 1 wherein the frequency generating range of the frequency modulator generator is 1 Khz to 100 KHz for bursts and 100 KHz to 20 MHZ for pulses within a burst.

3. Apparatus as set forth in claim 1 wherein the frequency generating range of the frequency modulator generator is one Khz to 100 KHz for bursts and 100 KHz to 20 MHZ for pulses within a burst and the duration of each pulse of the frequency modulator generator is in the range of 10 nanoseconds to 1 microsecond.

4. Apparatus as set forth in claim 1 wherein the voltage standard is approximately 50% of the peak of the audio waves.

5. Apparatus as set forth in claim 1 wherein the antenna is of the type that projects the microwaves in space to the head of a person.

6. Apparatus for creating human hearing comprising:

(a) an oscillator creating an electromagnetic carrier wave at a selected frequency in the range of 100 Mhz to 10,000 Mhz;

(b) a pulse generator connected to said oscillator to pulse the carrier with pulses having a width in the range of 10 nanoseconds to 1 microsecond with a minimum spacing between pulses of about 25 nanoseconds;

(c) a frequency modulator connected to the pulse generator;

(d) an audio signal generator connected to the modulator which modulates the pulses in accordance with the audio signal; and

(e) a transmitting antenna connected to the oscillator to transmit the carrier wave as thus modified to project the electromagnetic energy through space to the head of a person.

7. Apparatus as set forth in claim 6 wherein the modulator is a frequency modulator to vary the density of bursts within an audio envelope as a function of the audio amplitude.

8. The method of irradiating a person's head to produce sound in the head of the person comprising

(a) irridiating the head of a person with microwaves in the range of 100 Mhz to 10,000 Mhz;

(b) pulsing said microwaves with pulses in the range of 10 nanoseconds to 1 microsecond; and

(c) frequency modulating groups of pulses called bursts by audio waves wherein the modulation extends from 1 Khz to 100 Khz.

non-uniform rate of 1 to 100 KHz. This non-uniform spacing of bursts is created in the FM capable generator 12.

Referring to FIG. 2 there is illustrated an audio wave 27 generated by the audio input 10 wherein the horizontal axis is time and the vertical axis is voltage. For illustrative purposes the wave 27 is shown as having a voltage peak 28 on the left part of FIG. 2 and a voltage peak 29 of the right side of FIG. 2. The voltage standard 16 of FIG. 1 generates a dc voltage designated at 31 in FIG. 2. This standard voltage is preferably at about 50% of the peak voltage 28. The comparator 14 of FIG. 1 actuates the FM capable generator 12 only when the positive envelope of the audio wave 27 exceeds the voltage standard. The negative portions of the audio wave are not utilized.

Referring now to FIG. 3 there is illustrated two groups of bursts of microwave energy that are delivered by the antenna 22 of FIG. 1 to the head of the person 23. FIG. 3 has a horizontal time axis identical to the time axis of FIG. 2 and has a vertical axis that in this case represents the power of the microwaves from generator 19. At the left part of FIG. 3 are a plurality of microwave bursts 32 that occur on the time axis from the point of intersection of the standard voltage 31 with the positive part of the audio wave 27, designated as the time point 33 to time point 34 on FIG. 2. It will be noted in FIG. 3 that the bursts 32 are non-uniform in spacing and that they are closer together at the time of maximum audio voltage 28 and are more spread out toward the time points 33 and 34. This is the frequency modulation effected by the FM pulse generator 12.

Referring to the right part of FIG. 3 there are a plurality of microwave bursts 36 that are fewer in number and over a shorter time period than the pulses 32. These extend on the time axis of FIG. 2 from point 37 to point 38. These bursts 36 are also frequency modulated with the closest groupings appearing opposite peak 29 of FIG. 2 and greater spacing near time points 37 and 38.

Referring now to FIG. 4 there is illustrated the fact that a single burst shown as straight lines 32 or 36 on FIG. 3 are made up of ten to twenty separate microwave pulses. The duration of the burst is between 500 nanoseconds and 100 microseconds, with an optimum of 2 microseconds. The duration of each pulse within the burst is 10 nanoseconds to 1 microsecond and a time duration of 100 nanoseconds is preferred. The bursts 32 of FIG. 3 are spaced non-uniformly from each other caused by the frequency modulation of 12. FIG. 4 depicts a burst. Each vertical line 40 in FIG. 4 represents a single pulse. Each pulse is represented by the envelope 41 of FIG. 5. The pulses within a burst are spaced uniformly from eachother. The spacing between pulses may vary from 5 nanoseconds to 10 microseconds.

Referring now to FIG. 3, the concentration of bursts 32 opposite the peak 28 of FIG. 2 can be expressed as a frequency of repetition. I presently prefer to adjust the FM capable generator 12 to have a maximum frequency of repetition in the range of 25 Khz to 100 Khz. I deliberately keep this range low to reduce the amount of heating caused by the microwaves. The wider spacing of the pulses 32 opposite the cutoff points 33 and 34 of FIG. 2 can also be expressed as a frequency of reptition and I presently prefer a minimum repetition rate of 1 KHz. I find that this low repetition rate, altnough in the audio range, does not disrupt the transmission of auoio intelligence to the person 23. The aim, again, is to reduce the amount of heat transmitted to the subject 23.

OPERATION

Referring to FIG. 1, the intelligence to be perceived by the person 23 is introduced at the audio source 10 which may be a microphone for voice, or a tape player for music, instruction, etc. This audio signal is transmitted to the FM capable generator 12 and to the comparator 14. The comparator 14 compares the positive portions of the audio wave with voltage from the voltage standard 16 and when the audio wave instantaneously exceeds the standard voltage, the FM generator is actuated by the wire 17 connecting the comparator 14 and the FM generator 12. The FM generator 12 then sends a plurality of signals to the microwave generator 19 at each peak of the audio wave above the voltage standard.

This is shown graphically in FIGS. 2-5. The audio signal 27 of FIG. 2 exceeds the standard voltage 31 at point 33 whereupon the FM generator 12 starts emitting burst signals 32 at its lowest frequency of about 1 Khz. As time progresses past point 33 the voltage above the standard increases and the FM generator 12 responds by making the burst signals closer together until at peak 28 the maximum density of burst signals 32 is achieved, for example at a frequency of 50 Khz. The time duration of each pulse 40 (FIG. 4) is also controlled by a fixed adjustment of the FM generator 12 and for example the duration may be 100 nanoseconds.

The frequency modulated burst signals are delivered by FM generator 12 to the microwave generator as interrupted dc and the microwave generator is turned on in response to each pulse 40 and its output is delivered by coaxial cable 21 to the parabolic antenna 22 to project microwaves onto the head of a person 23. These microwaves penetrate the brain enough so that the electrical activity inside of the brain produces the sensation of sound. When the parameters are adjusted for the particular individual, he perceives intelligible audio, entirely independently of his external hearlng organs.

PRESENTLY PREFERRED QUANTITIES

As mentioned previously, I prefer rhat the standard voltage 31 of FIG. 2 be about 50% of peak audio voltage. This not only helps to reduce heating in the person 2 but also reduces spurious audio. This 50% is not vital and the useful range is 25% to 85% of peak audio.

The minimum burst repetition frequency (for example at time points 33 and 34) is preferably 1 KHz and the maximum repetition frequency is in the range of 25 KHz to 100 KHz, with the lower frequencies resulting in less heating.

The time duration of each individual pulse of microwave radiation is in the range of 10 nanoseconds to 1 microsecond as indicated in FIG. 5, with the shorter time periods resulting in less heating.

CONTROL OF POWER OUTPUT

As stated above, I maintain the power output of the parabolic antenna 22 within the present safe standard of 3.3 mw/cm2 (3.3 milliwatts per square centimeter). I control the power output by controlling the strengtn of the audio modulation. This results in a duty cycle of 0.005, the decimal measure of the time in any second that the transmitter is on full power. The peak power level can be between 500 mw and 5 w and at 0.005 duty cycle these peaks will result in an average power of 2.5 mw and 25 mw respectively. However, these values are further reduced by adjusting the audio modulation so that zero input produces a zero output. Since a voice signal, for example, is at maximum amplitude only a small fraction of the rime, the average power will be below the 3.3 mw/cm2 standard, even with 5 watts peak power.

THEORY OF OPERATION

I have not been able to experiment to determine how my microwave system works, but from my interpretation of prior work done in this field I believe that the process is as follows. Any group of bursts related to the audio ek 28 of FIG. 2 causes an increasing ultrasonic build up within the head of a human being starting with a low level for the first bursts pulses and building up to a high level with the last bursts pulses of a group. This buildup, I believe, causes the direct discharge of random brain neurons. These discharges at audio frequency create a perception of sound. This process, I believe, bypasses the normal hearing organs and can create sound in a person who is nerve-dead deaf. However, this theory of operation is only my guess and may prove to be in error in the future.

APPARATUS

The apparatus of FIG. 1 for carrying out my invention may include as a microwave generator Model PH40K of Applied Microwave Laboratories and described as Signal Source. The cable 21 connecting the microwave generator 19 and the antenna is RG8 coaxial cable by Belden Industries. The antenna 22 may be a standard parabolic antenna. The FM generator 12 has to be specially built to include the spacing runction which is obtained by a frequency generator built into a srandard FM generator.

I have described my invention witn respect to a presently preferred embodiment as required by the patent statutes. It will be apparent to those skilled in the technology that many variations, modification and additions can be made. All such variations, modifications and additions that come within the true spirit and scope of the invention are included in the claims.

PATENT CITATIONS

Cited Patent	Filing date	Publication date	Applicant	Title
US3629521 *	Jan 8, 1970	Dec 21, 1971	Intelectron Corp	Hearing systems
US3766331 *	Nov 24, 1971	Oct 16, 1973	Zcm Ltd	Hearing aid for producing sensations in the brain

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NON-PATENT CITATIONS

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3		Frey et al, "Human Perception . . . Energy" Science, 181,356-358, 1973.

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5		Jaski, "Radio Waves & Life", Radio-Electronics, pp. 45-45, Sep. 1960.
6	*	Jaski, Radio Waves & Life , Radio Electronics, pp. 45 45, Sep. 1960.
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Citing Patent	Filing date	Publication date	Applicant	Title
US5159703 *	Dec 28, 1989	Oct 27, 1992	Lowery Oliver M	Silent subliminal presentation system
EP0543152A2 *	Oct 18, 1992	May 26, 1993	Ortlib, Sergej	Device for stimulating the functional state of a biological object
WO1993010730A1 *	Nov 26, 1992	Jun 10, 1993	Thijs Jamin Anneliesje & Hf	Hearing aid based on microwaves
WO2004014485A1 *	Jul 30, 2003	Feb 19, 2004	Szul Igor Roman	Electromagnetic wave therapy treatment method and apparatus

* Cited by examiner

CLASSIFICATIONS

U.S. Classification	607/56
International Classification	A61F11/04
Cooperative Classification	A61F11/04
European Classification	A61F11/04

LEGAL EVENTS

Date	Code	Event	Description
Jun 1, 1993	REMI	Maintenance fee reminder mailed	
Oct 31, 1993	REIN	Reinstatement after maintenance fee payment confirmed	
Jan 11, 1994	FP	Expired due to failure to pay maintenance fee	**Effective date:** 19931031
Aug 16, 1995	FPAY	Fee payment	**Year of fee payment:** 4
Aug 16, 1995	SULP	Surcharge for late payment	
Nov 14, 1995	PRDP	Patent reinstated due to the acceptance of a late maintenance fee	**Effective date:** 19950915
Nov 7, 1996	FPAY	Fee payment	**Year of fee payment:** 8
Mar 23, 2001	FPAY	Fee payment	**Year of fee payment:** 12

Nervous system manipulation by electromagnetic fields from monitors
US 6506148 B2

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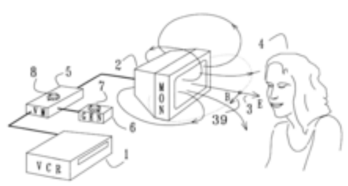
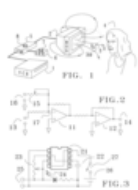
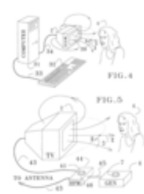
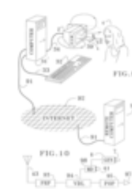
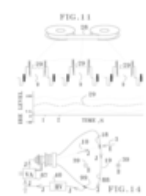
External Links: USPTO, USPTO Assignment, Espacenet

ABSTRACT

Physiological effects have been observed in a human subject in response to stimulation of the skin with weak electromagnetic fields that are pulsed with certain frequencies near ½ Hz or 2.4 Hz, such as to excite a sensory resonance. Many computer monitors and TV tubes, when displaying pulsed images, emit pulsed electromagnetic fields of sufficient amplitudes to cause such excitation. It is therefore possible to manipulate the nervous system of a subject by pulsing images displayed on a nearby computer monitor or TV set. For the latter, the image pulsing may be imbedded in the program material, or it may be overlaid by modulating a video stream, either as an RF signal or as a video signal. The image displayed on a computer monitor may be pulsed effectively by a simple computer program. For certain monitors, pulsed electromagnetic fields capable of exciting sensory resonances in nearby subjects may be generated even as the displayed images are pulsed with subliminal intensity.

IMAGES (10)


DESCRIPTION

BACKGROUND OF THE INVENTION

The invention relates to the stimulation of the human nervous system by an electromagnetic field applied externally to the body. A neurological effect of external electric fields has been mentioned by Wiener (1958), in a discussion of the bunching of brain waves through nonlinear interactions. The electric field was arranged to provide "a direct electrical driving of the brain". Wiener describes the field as set up by a 10 Hz alternating voltage of 400 V applied in a room between ceiling and ground. Brennan (1992) describes in U.S. Pat. No. 5,169,380 an apparatus for alleviating disruptions in circadian rythms of a mammal, in which an alternating electric field is applied across the head of the subject by two electrodes placed a short distance from the skin.

A device involving a field electrode as well as a contact electrode is the "Graham Potentializer" mentioned by Hutchison (1991). This relaxation device uses motion, light and sound as well as an alternating electric field applied mainly to the head. The contact electrode is a metal bar in Ohmic contact with the bare feet of the

CLAIMS (14)

I claim:

1. A method for manipulating the nervous system of a subject located near a monitor, the monitor emitting an electromagnetic field when displaying an image by virtue of the physical display process, the subject having a sensory resonance frequency, the method comprising:

creating a video signal for displaying an image on the monitor, the image having an intensity;

modulating the video signal for pulsing the image intensity with a frequency in the range 0.1 Hz to 15 Hz; and

setting the pulse frequency to the resonance frequency.

2. A computer program for manipulating the nervous system of a subject located near a monitor, the monitor emitting an electromagnetic field when displaying an image by virtue of the physical display process, the subject having cutaneous

subject, and the field electrode is a hemispherical metal headpiece placed several inches from the subject's head.

In these three electric stimulation methods the external electric field is applied predominantly to the head, so that electric currents are induced in the brain in the physical manner governed by electrodynamics. Such currents can be largely avoided by applying the field not to the head, but rather to skin areas away from the head. Certain cutaneous receptors may then be stimulated and they would provide a signal input into the brain along the natural pathways of afferent nerves. It has been found that, indeed, physiological effects can be induced in this manner by very weak electric fields, if they are pulsed with a frequency near ½ Hz. The observed effects include ptosis of the eyelids, relaxation, drowziness, the feeling of pressure at a centered spot on the lower edge of the brow, seeing moving patterns of dark purple and greenish yellow with the eyes closed, a tonic smile, a tense feeling in the stomach, sudden loose stool, and sexual excitement, depending on the precise frequency used, and the skin area to which the field is applied. The sharp frequency dependence suggests involvement of a resonance mechanism.

It has been found that the resonance can be excited not only by externally applied pulsed electric fields, as discussed in U.S. Pat. Nos. 5,782,874, 5,899,922, 6,081,744, and 6,167,304, but also by pulsed magnetic fields, as described in U.S. Pat. Nos. 5,935,054 and 6,238,333, by weak heat pulses applied to the skin, as discussed in U.S. Pat. Nos. 5,800,481 and 6,091,994, and by subliminal acoustic pulses, as described in U.S. Pat. No. 6,017,302. Since the resonance is excited through sensory pathways, it is called a sensory resonance. In addition to the resonance near ½ Hz, a sensory resonance has been found near 2.4 Hz. The latter is characterized by the slowing of certain cortical processes, as discussed in the '481, '922, '302, '744, '944, and '304 patents.

The excitation of sensory resonances through weak heat pulses applied to the skin provides a clue about what is going on neurologically. Cutaneous temperature-sensing receptors are known to fire spontaneously. These nerves spike somewhat randomly around an average rate that depends on skin temperature. Weak heat pulses delivered to the skin in periodic fashion will therefore cause a slight frequency modulation (fm) in the spike patterns generated by the nerves. Since stimulation through other sensory modalities results in similar physiological effects, it is believed that frequency modulation of spontaneous afferent neural spiking patterns occurs there as well.

It is instructive to apply this notion to the stimulation by weak electric field pulses administered to the skin. The externally generated fields induce electric current pulses in the underlying tissue, but the current density is much too small for firing an otherwise quiescent nerve. However, in experiments with adapting stretch receptors of the crayfish, Terzuolo and Bullock (1956) have observed that very small electric fields can suffice for modulating the firing of already active nerves. Such a modulation may occur in the electric field stimulation under discussion.

Further understanding may be gained by considering the electric charges that accumulate on the skin as a result of the induced tissue currents. Ignoring thermodynamics, one would expect the accumulated polarization charges to be confined strictly to the outer surface of the skin. But charge density is caused by a slight excess in positive or negative ions, and thermal motion distributes the ions through a thin layer. This implies that the externally applied electric field actually penetrates a short distance into the tissue, instead of stopping abruptly at the outer skin surface. In this manner a considerable fraction of the applied field may be brought to bear on some cutaneous nerve endings, so that a slight modulation

nerves that fire spontaneously and have spiking patterns, the computer program comprising:

a display routine for displaying an image on the monitor, the image having an intensity;

a pulse routine for pulsing the image intensity with a frequency in the range 0.1 Hz to 15 Hz; and

a frequency routine that can be internally controlled by the subject, for setting the frequency;

whereby the emitted electromagnetic field is pulsed, the cutaneous nerves are exposed to the pulsed electromagnetic field, and the spiking patterns of the nerves acquire a frequency modulation.

3. The computer program of claim 2, wherein the pulsing has an amplitude and the program further comprises an amplitude routine for control of the amplitude by the subject.

4. The computer program of claim 2, wherein the pulse routine comprises:

a timing procedure for timing the pulsing; and

an extrapolation procedure for improving the accuracy of the timing procedure.

5. The computer program of claim 2, further comprising a variability routine for introducing variability in the pulsing.

6. Hardware means for manipulating the nervous system of a subject located near a monitor, the monitor being responsive to a video stream and emitting an electromagnetic field when displaying an image by virtue of the physical display process, the image having an intensity, the subject having cutaneous nerves that fire spontaneously and have spiking patterns, the hardware means comprising:

pulse generator for generating voltage pulses;

means, responsive to the voltage pulses, for modulating the video stream to pulse the image intensity;

whereby the emitted electromagnetic field is pulsed, the cutaneous nerves are exposed to the pulsed electromagnetic field, and the spiking patterns of the nerves acquire a frequency modulation.

7. The hardware means of claim 6, wherein the video stream is a composite video signal that has a pseudo-dc level, and the means for modulating the video stream comprise means for pulsing the pseudo-dc level.

8. The hardware means of claim 6, wherein the video stream is a television broadcast signal, and the means for modulating the video stream comprise means for frequency wobbling of the television broadcast signal.

9. The hardware means of claim 6, wherein the monitor has a brightness adjustment terminal, and the means for modulating the video stream comprise a connection from the pulse generator to the brightness adjustment terminal.

of the type noted by Terzuolo and Bullock may indeed occur.

The mentioned physiological effects are observed only when the strength of the electric field on the skin lies in a certain range, called the effective intensity window. There also is a bulk effect, in that weaker fields suffice when the field is applied to a larger skin area. These effects are discussed in detail in the '922 patent.

Since the spontaneous spiking of the nerves is rather random and the frequency modulation induced by the pulsed field is very shallow, the signal to noise ratio (S/N) for the fm signal contained in the spike trains along the afferent nerves is so small as to make recovery of the fm signal from a single nerve fiber impossibile. But application of the field over a large skin area causes simultaneous stimulation of many cutaneous nerves, and the fm modulation is then coherent from nerve to nerve. Therefore, if the afferent signals are somehow summed in the brain, the fm modulations add while the spikes from different nerves mix and interlace. In this manner the S/N can be increased by appropriate neural processing. The matter is discussed in detail in the '874 patent. Another increase in sensitivity is due to involving a resonance mechanism, wherein considerable neural circuit oscillations can result from weak excitations.

An easily detectable physiological effect of an excited ½ Hz sensory resonance is ptosis of the eyelids. As discussed in the '922 patent, the ptosis test involves first closing the eyes about half way. Holding this eyelid position, the eyes are rolled upward, while giving up voluntary control of the eyelids. The eyelid position is then determined by the state of the autonomic nervous system. Furthermore, the pressure excerted on the eyeballs by the partially closed eyelids increases parasympathetic activity. The eyelid position thereby becomes somewhat labile, as manifested by a slight flutter. The labile state is sensitive to very small shifts in autonomic state. The ptosis influences the extent to which the pupil is hooded by the eyelid, and thus how much light is admitted to the eye. Hence, the depth of the ptosis is seen by the subject, and can be graded on a scale from 0 to 10.

In the initial stages of the excitation of the ½ Hz sensory resonance, a downward drift is detected in the ptosis frequency, defined as the stimulation frequency for which maximum ptosis is obtained. This drift is believed to be caused by changes in the chemical milieu of the resonating neural circuits. It is thought that the resonance causes perturbations of chemical concentrations somewhere in the brain, and that these perturbations spread by diffusion to nearby resonating circuits. This effect, called “chemical detuning”, can be so strong that ptosis is lost altogether when the stimulation frequency is kept constant in the initial stages of the excitation. Since the stimulation then falls somewhat out of tune, the resonance decreases in amplitude and chemical detuning eventually diminishes. This causes the ptosis frequency to shift back up, so that the stimulation is more in tune and the ptosis can develop again. As a result, for fixed stimulation frequencies in a certain range, the ptosis slowly cycles with a frequency of several minutes. The matter is discussed in the '302 patent.

The stimulation frequencies at which specific physiological effects occur depend somewhat on the autonomic nervous system state, and probably on the endocrine state as well.

Weak magnetic fields that are pulsed with a sensory resonance frequency can induce the same physiological effects as pulsed electric fields. Unlike the latter however, the magnetic fields penetrate biological tissue with nearly undiminished strength. Eddy currents in the tissue drive electric charges to the skin, where the charge distributions are subject to thermal smearing in much the same way as in electric field stimulation, so that the same physiological effects develop. Details are discussed in the '054 patent.

SUMMARY

Computer monotors and TV monitors can be made to emit weak low-frequency electromagnetic fields merely by pulsing the

10. A source of video stream for manipulating the nervous system of a subject located near a monitor, the monitor emitting an electromagnetic field when displaying an image by virtue of the physical display process, the subject having cutaneous nerves that fire spontaneously and have spiking patterns, the source of video stream comprising:

means for defining an image on the monitor, the image having an intensity; and

means for subliminally pulsing the image intensity with a frequency in the range 0.1 Hz to 15 Hz;

whereby the emitted electromagnetic field is pulsed, the cutaneous nerves are exposed to the pulsed electromagnetic field, and the spiking patterns of the nerves acquire a frequency modulation.

11. The source of video stream of claim 10 wherein the source is a recording medium that has recorded data, and the means for subliminally pulsing the image intensity comprise an attribute of the recorded data.

12. The source of video stream of claim 10 wherein the source is a computer program, and the means for subliminally pulsing the image intensity comprise a pulse routine.

13. The source of video stream of claim 10 wherein the source is a recording of a physical scene, and the means for subliminally pulsing the image intensity comprise:

pulse generator for generating voltage pulses;

light source for illuminating the scene, the light source having a power level; and

modulation means, responsive to the voltage pulses, for pulsing the power level.

14. The source of video stream of claim 10, wherein the source is a DVD, the video stream comprises a luminance signal and a chrominance signal, and the means for subliminal pulsing of the image intensity comprise means for pulsing the luminance signal.

intensity of displayed images. Experiments have shown that the ½ Hz sensory resonance can be excited in this manner in a subject near the monitor. The 2.4 Hz sensory resonance can also be excited in this fashion. Hence, a TV monitor or computer monitor can be used to manipulate the nervous system of nearby people.

The implementations of the invention are adapted to the source of video stream that drives the monitor, be it a computer program, a TV broadcast, a video tape or a digital video disc (DVD).

For a computer monitor, the image pulses can be produced by a suitable computer program. The pulse frequency may be controlled through keyboard input, so that the subject can tune to an individual sensory resonance frequency. The pulse amplitude can be controlled as well in this manner. A program written in Visual Basic(R) is particularly suitable for use on computers that run the Windows 95(R) or Windows 98(R) operating system. The structure of such a program is described. Production of periodic pulses requires an accurate timing procedure. Such a procedure is constructed from the GetTimeCount function available in the Application Program Interface (API) of the Windows operating system, together with an extrapolation procedure that improves the timing accuracy.

Pulse variability can be introduced through software, for the purpose of thwarting habituation of the nervous system to the field stimulation, or when the precise resonance frequency is not known. The variability may be a pseudo-random variation within a narrow interval, or it can take the form of a frequency or amplitude sweep in time. The pulse variability may be under control of the subject.

The program that causes a monitor to display a pulsing image may be run on a remote computer that is connected to the user computer by a link; the latter may partly belong to a network, which may be the Internet.

For a TV monitor, the image pulsing may be inherent in the video stream as it flows from the video source, or else the stream may be modulated such as to overlay the pulsing. In the first case, a live TV broadcast can be arranged to have the feature imbedded simply by slightly pulsing the illumination of the scene that is being broadcast. This method can of course also be used in making movies and recording video tapes and DVDs.

Video tapes can be edited such as to overlay the pulsing by means of modulating hardware. A simple modulator is discussed wherein the luminance signal of composite video is pulsed without affecting the chroma signal. The same effect may be introduced at the consumer end, by modulating the video stream that is produced by the video source. A DVD can be edited through software, by introducing pulse-like variations in the digital RGB signals. Image intensity pulses can be overlaid onto the analog component video output of a DVD player by modulating the luminance signal component. Before entering the TV set, a television signal can be modulated such as to cause pulsing of the image intensity by means of a variable delay line that is connected to a pulse generator.

Certain monitors can emit electromagnetic field pulses that excite a sensory resonance in a nearby subject, through image pulses that are so weak as to be subliminal. This is unfortunate since it opens a way for mischievous application of the invention, whereby people are exposed unknowingly to manipulation of their nervous systems for someone else's purposes. Such application would be unethical and is of course not advocated. It is mentioned here in order to alert the public to the possibility of covert abuse that may occur while being online, or while watching TV, a video, or a DVD.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the electromagnetic field that emanates from a monitor when the video signal is modulated such as to cause pulses in image intensity, and a nearby subject who is exposed to the field.

FIG. 2 shows a circuit for modulation of a composite video signal for the purpose of pulsing the image intensity.

FIG. 3 shows the circuit for a simple pulse generator.

FIG. 4 illustrates how a pulsed electromagnetic field can be generated with a computer monitor.

FIG. 5 shows a pulsed electromagnetic field that is generated by a television set through modulation of the RF signal input to the TV.

FIG. 6 outlines the structure of a computer program for producing a pulsed image.

FIG. 7 shows an extrapolation procedure introduced for improving timing accuracy of the program of FIG. **6**.

FIG. 8 illustrates the action of the extrapolation procedure of FIG. **7**.

FIG. 9 shows a subject exposed to a pulsed electromagnetic field emanating from a monitor which is responsive to a program running on a remote computer via a link that involves the Internet.

FIG. 10 shows the block diagram of a circuit for frequency wobbling of a TV signal for the purpose of pulsing the intensity of the image displayed on a TV monitor.

FIG. 11 depicts schematically a recording medium in the form of a video tape with recorded data, and the attribute of the signal that causes the intensity of the displayed image to be pulsed.

FIG. 12 illustrates how image pulsing can be embedded in a video signal by pulsing the illumination of the scene that is being recorded.

FIG. 13 shows a routine that introduces pulse variability into the computer program of FIG. **6**.

FIG. 14 shows schematically how a CRT emits an electromagnetic field when the displayed image is pulsed.

FIG. 15 shows how the intensity of the image displayed on a monitor can be pulsed through the brightness control terminal of the monitor.

FIG. 16 illustrates the action of the polarization disc that serves as a model for grounded conductors in the back of a CRT screen.

FIG. 17 shows the circuit for overlaying image intensity pulses on a DVD output.

FIG. 18 shows measured data for pulsed electric fields emitted by two different CRT type monitors, and a comparison with theory.

DETAILED DESCRIPTION

Computer monitors and TV monitors emit electromagnetic fields. Part of the emission occurs at the low frequencies at which displayed images are changing. For instance, a rythmic pulsing of the intensity of an image causes electromagnetic field emission at the pulse frequency, with a strength proportional to the pulse amplitude. The field is briefly referred to as “screen emission”. In discussing this effect, any part or all what is displayed on the monitor screen is called an image. A monitor of the cathode ray tube (CRT) type has three electron beams, one for each of the basic colors red, green, and blue. The intensity of an image is here defined as

$$I=\int j\, dA, \qquad (1)$$

where the integral extends over the image, and

$$j=jr+jg+jb, \qquad (2)$$

jr, jg, and jb being the electric current densities in the red, green, and blue electron beams at the surface area dA of the image on the screen. The current densities are to be taken in the distributed electron beam model, where the discreteness of pixels and the raster motion of the beams are ignored, and the back of the monitor screen is thought to be irradiated by diffuse electron beams. The beam current densities are then functions of the coordinates x and y over the screen. The model is appropriate since we are interested in the electromagnetic field emision caused by image pulsing with the very low frequencies of sensory resonances, whereas the emissions with the much higher horizontal and vertical sweep frequencies are of no concern. For a CRT the intensity of an image is expressed in millamperes.

For a liquid crystal display (LCD), the current densities in the definition of image intensity are to be replaced by driving voltages, multiplied by the aperture ratio of the device. For an LCD, image intensities are thus expressed in volts.

It will be shown that for a CRT or LCD screen emissions are caused by fluctuations in image intensity. In composite video however, intensity as defined above is not a primary signal feature, but luminance Y is. For any pixel one has

$$Y=0.299R+0.587G+0.114B, \qquad (3)$$

where R, G, and B are the intensities of the pixel respectively in red, green and blue, normalized such as to range from 0 to 1. The definition (3) was provided by the Commission Internationale de l'Eclairage (CIE), in order to account for brightness differences at different colors, as perceived by the human visual system. In composite video the hue of the pixel is determined by the chroma signal or chrominance, which has the components R-Y and B-Y It follows that pulsing pixel luminance while keeping the hue fixed is equivalent to pulsing the pixel intensity, up to an amplitude factor. This fact will be relied upon when modulating a video stream such as to overlay image intensity pulses.

It turns out that the screen emission has a multipole expansion wherein both monopole and dipole contributions are proportional to the rate of change of the intensity I of (1). The higher order multipole contributions are proportional to the rate of change of moments of the current density j over the image, but since these contributions fall off rapidly with distance, they are not of practical importance in the present context. Pulsing the intensity of an image may involve different pulse amplitudes, frequencies, or phases for different parts of the image. Any or all of these features may be under subject control.

The question arises whether the screen emission can be strong enough to excite sensory resonances in people located at normal viewing distances from the monitor. This turns out to be the case, as shown by sensory resonance experiments and independently by measuring the strength of the emitted electric field pulses and comparing the results with the effective intensity window as explored in earlier work.

One-half Hertz sensory resonance experiments have been conducted with the subject positioned at least at normal viewing distance from a 15″ computer monitor that was driven by a computer program written in Visual Basic(R), version 6.0 (VB**6**). The program produces a pulsed image with uniform luminance and hue over the full screen, except for a few small control buttons and text boxes. In VB**6**, screen pixel colors are determined by integers R, G, and B, that range from 0 to 255, and set the contributions to the pixel color made by the basic colors red, green, and blue. For a CRT-type monitor, the pixel intensities for the primary colors may depend on the RGB values in a nonlinear manner that will be discussed. In the VB**6** program the RGB values are modulated by small pulses ΔR, ΔG, ΔB, with a frequency that can be chosen by the subject or is swept in a predetermined manner. In the sensory resonance experiments mentioned above, the ratios ΔR/R, ΔG/G, and ΔB/B were always smaller than 0.02, so that the image pulses are quite weak. For certain frequencies near ½ Hz, the subject experienced physiological effects that are known to accompany the excitation of the ½ Hz sensory resonance as mentioned in the Background Section. Moreover, the measured field pulse amplitudes fall within the effective intensity window for the ½ Hz resonance, as explored in earlier experiments and discussed in the '874, '744, '922, and '304 patents. Other experiments have shown that the 2.4 Hz sensory resonance can be exited as well by screen emissions from monitors that display pulsed images.

These results confirm that, indeed, the nervous system of a subject can be manipulated through electromagnetic field pulses emitted by a nearby CRT or LCD monitor which displays images with pulsed intensity.

The various implementations of the invention are adapted to the different sources of video stream, such as video tape, DVD, a computer program, or a TV broadcast through free space or cable. In all of these implementations, the subject is exposed to the pulsed electromagnetic field that is generated by the monitor as the result of image intensity pulsing. Certain cutaneous nerves of the subject exhibit spontaneous spiking in patterns which, although rather random, contain sensory information at least in the form of average frequency. Some of these nerves have receptors that respond to the field stimulation by changing their average spiking frequency, so that the spiking patterns of these nerves acquire a frequency modulation, which is conveyed to the brain. The modulation can be particularly effective if it has a frequency at or near a sensory resonance frequency. Such frequencies are expected to lie in the range from 0.1 to 15 Hz.

An embodiment of the invention adapted to a VCR is shown in FIG. 1, where a subject **4** is exposed to a pulsed electric field **3** and a pulsed magnetic field **39** that are emitted by a monitor **2**, labeled “MON”, as the result of pulsing the intensity of the displayed image. The image is here generated by a video casette recorder **1**, labeled “VCR”, and the pulsing of the image intensity is obtained by modulating the composite video signal from the VCR output. This is done by a video modulator **5**, labeled “VM”, which responds to the signal from the pulse generator **6**, labeled “GEN”. The frequency and amplitude of the image pulses can be adjusted with the frequency control **7** and amplitude control **8**. Frequency and amplitude adjustments can be made by the subject.

The circuit of the video modulator **5** of FIG. 1 is shown in FIG. 2, where the video amplifiers **11** and **12** process the composite video signal that enters at the input terminal **13**. The level of the video signal is modulated slowly by injecting a small bias current at the inverting input **17** of the first amplifier **11**. This current is caused by voltage pulses supplied at the modulation input **16**, and can be adjusted through the potentiometer **15**. Since the noninverting input of the amplifier is grounded, the inverting input **17** is kept essentially at ground potential, so that the bias current is is not influenced by the video signal. The inversion of the signal by the first amplifier **11** is undone by the second amplifier **12**. The gains of the amplifiers are chosen such as to give a unity overall gain. A slowly varying current injected at the inverting input **17** causes a slow shift in the “pseudo-dc” level of the composite video signal, here defined as the short-term average of the signal. Since the pseudo-dc level of the chroma signal section determines the luminance, the latter is modulated by the injected current pulses. The chroma signal is not affected by the slow modulation of the pseudodc level, since that signal is determined by the amplitude and phase with respect to the color carrier which is locked to the color burst. The effect on the sync pulses and color bursts is of no consequence either if the injected current pulses are very small, as they are in practice. The modulated composite video signal, available at the output **14** in FIG. 2, will thus exhibit a modulated luminance, whereas the chroma signal is unchanged. In the light of the foregoing discussion about luminance and intensity, it follows that the modulator of FIG. 2 causes a pulsing of the image intensity I. It remains to give an example how the pulse signal at the modulation input **16** may be obtained. FIG. 3 shows a pulse generator that is suitable for this purpose, wherein the RC timer **21** (Intersil ICM7555) is hooked up for astable operation and produces a square wave voltage with a frequency that is determined by capacitor **22** and potentiometer **23**. The timer **21** is powered by a battery **26**, controlled by the switch **27**. The square wave voltage at output **25** drives the LED **24**, which may be used for monitoring of the pulse frequency, and also serves as power indicator. The pulse output may be rounded in ways that are well known in the art. In the setup of FIG. 1, the output of VCR **1** is connected to the video input **13** of FIG. 2, and the video output **14** is connected to the monitor **2** of FIG. **1**.

In the preferred embodiment of the invention, the image intensity pulsing is caused by a computer program. As shown in FIG. 4, monitor **2**, labeled “MON”, is connected to computer **31** labeled “COMPUTER”, which runs a program that produces an image on the monitor and causes the image intensity to be pulsed. The subject **4** can provide input to the computer through the keyboard **32** that is connected to the computer by the connection **33**. This input may involve adjustments of the frequency or the amplitude or the variability of the image intensity pulses. In particular, the pulse frequency can be set to a sensory resonance frequency of the subject for the purpose of exciting the resonance.

The structure of a computer program for pulsing image intensity is shown in FIG. **6**. The program may be written in Visual Basic(R) version 6.0 (VB**6**), which involves the graphics interface familiar from the Windows(R) operating system. The images appear as forms equipped with user controls such as command buttons and scroll bars, together with data displays such as text boxes. A compiled VB**6** program is an executable file. When activated, the program declares variables and functions to be called from a dynamic link library (DLL) that is attached to the operating system; an initial form load is performed as well. The latter comprises setting the screen color as specified by integers R, G, and B in the range 0 to 255, as mentioned above. In FIG. 6, the initial setting of the screen color is labeled as **50**. Another action of the form load routine is the computation **51** of the sine function at eight equally spaced points, I=0 to 7, around the unit circle. These values are needed when modulating the RGB numbers. Unfortunately, the sine function is distorted by the rounding to integer RGB values that occurs in the VB**6** program. The image is chosen to fill as much of the screen area as possible, and it has spatially uniform luminance and hue.

The form appearing on the monitor displays a command button for starting and stopping the image pulsing, together with scroll bars **52** and **53** respectively for adjustment of the pulse frequency F and the pulse amplitude A. These pulses could be initiated by a system timer which is activated upon the elapse of a preset time interval. However, timers in VB**6** are too inaccurate for the purpose of providing the eight RGB adjustment points in each pulse cycle. An improvement can be obtained by using the GetTickCount function that is available in the Application Program Interface (API) of Windows 95(R) and Windows 98(R). The GetTickCount function returns the system time that has elapsed since starting Windows, expressed in milliseconds. User activation of the start button **54** provides a tick count TN through request **55** and sets the timer interval to TT miliseconds, in step **56**. TT was previously calculated in the frequency routine that is activated by changing the frequency, denoted as step **52**.

Since VB**6** is an event-driven program, the flow chart for the program falls into disjoint pieces. Upon setting the timer interval to TT in step **56**, the timer runs in the background while the program may execute subroutines such as adjustment of pulse frequency or amplitude. Upon elapse of the timer interval TT, the timer subroutine **57** starts execution with request **58** for a tick count, and in **59** an upgrade is computed of the time TN for the next point at which the RGB values are to be adjusted. In step **59** the timer is turned off, to be reactivated later in step **67**. Step **59** also resets the parameter CR which plays a role in the extrapolation procedure **61** and the condition **60**. For ease of understanding at this point, it is best to pretend that the action of **61** is simply to get a tick count, and to consider the loop controled by condition **60** while keeping CR equal to zero. The loop would terminate when the tick count M reaches or exceeds the time TN for the next phase point, at which time the program should adjust the image intensity through steps **63**-**65**. For now step **62** is to be ignored also, since it has to do with the actual extrapolation procedure **61**. The increments to the screen colors R**1**, G**1**, and B**1** at the new phase point are computed according to the sine function, applied with the amplitude A that was set by the user in step **53**. The number I that labels the phase point is incremented by unity in step **65**, but if this results in I=8 the value is reset to zero in **66**. Finally, the timer is reactivated in step **67**, initiating a new ⅛-cycle step in the periodic progression of RGB adjustments.

A program written in this way would exhibit a large jitter in the times at which the RGB values are changed. This is due to the lumpiness in the tick counts returned by the GetTickCount function. The lumpiness may be studied separately by running a simple loop with C=GetTickCount, followed by writing the result C to a file. Inspection shows that C has jumped every 14 or 15 milliseconds, between long stretches of constant values. Since for a ½ Hz image intensity modulation the ⅛-cycle phase points are 250 ms apart, the lumpiness of 14 or 15 ms in the tick count would cause considerable inaccuracy. The full extrapolation procedure **61** is introduced in order to diminish the jitter to acceptable levels. The procedure works by refining the heavy-line staircase function shown in FIG. 8, using the slope RR of a recent staircase step to accurately determine the loop count **89** at which the loop controled by **60** needs to be exited. Details of the extrapolation procedure are shown in FIG. **7** and illustrated in FIG. **8**. The procedure starts at **70** with both flags off, and CR=0, because of the assignment in **59** or **62** in FIG. 6. A tick count M is obtained at **71**, and the remaining time MR to the next phase point is computed in **72**. Conditions **77** and **73** are not satisfied and therefore passed vertically in the flow chart, so that only the delay block **74** and the assignments **75** are executed. Condition **60** of FIG. 6 is checked and found to be satisfied, so that the extrapolation procedure is reentered. The process is repeated until the condition **73** is met when the remaining time MR jumps down through the 15 ms level, shown in FIG. 8 as the transition **83**. The condition **73** then directs the logic flow to the assignments **76**, in which the number DM labeled by **83** is computed, and FLG**1** is set. The computation of DM is required for finding the slope RR of the straight-line element **85**. One also needs the “Final LM” **86**, which is the number of loops traversed from step **83** to the next downward step **84**, here shown to cross the MR=0 axis. The final LM is determined after repeatedly incrementing LM through the side loop entered from the FLG**1**=1 condition **77**, which is now satisfied since FLG**1** was set in step **76**. At the transition **84** the condition **78** is met, so that the assignments **79** are executed. This includes computation of the slope RR of the line element **85**, setting FLG**2**, and resetting FLG**1**. From here on, the extrapolation procedure increments CR in steps of RR while skipping tick counts until condition **60** of FIG. 6 is violated, the loop is exited, and the RGB values are adjusted.

A delay block **74** is used in order to stretch the time required for traversing the extrapolation procedure. The block can be any computation intensive subroutine such as repeated calculations of tangent and arc tangent functions.

As shown in step **56** of FIG. 6, the timer interval TT is set to 4/10 of the time TA from one RGB adjustment point to the next. Since the timer runs in the background, this arrangement provides an opportunity for execution of other processes such as user adjustment of frequency or amplitude of the pulses.

The adjustment of the frequency and other pulse parameters of the image intensity modulation can be made internally, i.e., within the running program. Such internal control is to be distinguished from the external control provided, for instance, in screen savers. In the latter, the frequency of animation can be modified by the user, but only after having exited the screen saver program. Specifically, in Windows 95(R) or Windows 98(R), to change the animation frequency requires stopping the screen saver execution by moving the mouse, whereafter the frequency may be adjusted through the control panel. The requirement that the control be internal sets the present program apart from so-called banners as well.

The program may be run on a remote computer that is linked to the user computer, as illustrated in FIG. **9**. Although the monitor **2**, labeled “MON”, is connected to the computer **31′**, labeled “COMPUTER”, the program that pulses the images on the monitor **2** runs on the remoter computer **90**, labeled “REMOTE COMPUTER”, which is connected to computer **31′** through a link **91** which may in part belong to a network. The network may comprise the Internet **92**.

The monitor of a television set emits an electromagnetic field in much the same way as a computer monitor. Hence, a TV may be used to produce screen emissions for the purpose of nervous system manipulation. FIG. 5 shows such an arrangement, where the pulsing of the image intensity is achieved by inducing a small slowly pulsing shift in the frequency of the RF signal that enters from the antenna. This process is here called “frequency wobbling” of the RF signal. In FM TV, a slight slow frequency wobble of the RF signal produces a pseudo-dc signal level fluctuation in the composite video signal, which in turn causes a slight intensity fluctuation of the image displayed on the monitor in the same manner as discussed above for the modulator of FIG. **2**. The frequency wobbling is induced by the wobbler **44** of FIG. 5 labeled “RFM”, which is placed in the antenna line **43**. The wobbler is driven by the pulse generator **6**, labeled “GEN”. The subject can adjust the frequency and the amplitude of the wobble through the tuning control **7** and the amplitude control **41**. FIG. 10 shows a block diagram of the frequency wobbler circuit that employs a variable delay line **94**, labelled “VDL”. The delay is determined by the signal from pulse generator **6**, labelled “GEN”. The frequency of the pulses can be adjusted with the tuning control **7**. The amplitude of the pulses is determined by the unit **98**, labelled “MD”, and can be adjusted with the amplitude control **41**. Optionally, the input to the delay line may be routed through a preprocessor **93**, labelled “PRP”, which may comprise a selective RF amplifier and down converter; a complimentary up conversion should then be performed on the delay line output by a postprocessor **95**, labelled “POP”. The output **97** is to be connected to the antenna terminal of the TV set.

The action of the variable delay line **94** may be understood as follows. Let periodic pulses with period L be presented at the input. For a fixed delay the pulses would emerge at the output with the same period L. Actually, the time delay T is varied slowly, so that it increases approximately by LdT/dt between the emergence of consecutive pulses at the device output. The pulse period is thus increased approximately by

$\Delta L=LdT/dt.$ (4)

In terms of the frequency ∫, Eq. (4) implies approximately

$\Delta\int/\int=-dT/dt.$ (5)

For sinusoidal delay T(t) with amplitude b and frequency g, one has

$\Delta\int/\int=-2\pi gb\cos(2\pi gt),$ (6)

which shows the frequency wobbling. The approximation is good for gb<<1, which is satisfied in practice. The relative frequency shift amplitude 2πgb that is required for effective image intensity pulses is very small compared to unity. For a pulse frequency g of the order of 1 Hz, the delay may have to be of the order of a millisecond. To accomodate such long delay values, the delay line may have to be implemented as a digital device. To do so is well within the present art. In that case it is natural to also choose digital implementations for the pulse generator **6** and the pulse amplitude controller **98**, either as hardware or as software.

Pulse variability may be introduced for alleviating the need for precise tuning to a resonance frequency. This may be important when sensory resonance frequencies are not precisely known, because of the variation among individuals, or in order to cope with the frequency drift that results from chemical detuning that is discussed in the '874 patent. A field with suitably chosen pulse variability can then be more effective than a fixed frequency field that is out of tune. One may also control tremors and seizures, by interfering with the pathological oscillatory activity of neural circuits that occurs in these disorders. Electromagnetic fields with a pulse variability that results in a narrow spectrum of frequencies around the frequency of the pathological oscillatory activity may then evoke nerve signals that cause phase shifts which diminish or quench the oscillatory activity.

Pulse variability can be introduced as hardware in the manner described in the '304 patent. The variability may also be introduced in the computer program of FIG. 6, by setting FLG**3** in step **68**, and choosing the amplitude B of the frequency fluctuation. In the variability routine **46**, shown in some detail in FIG. 13, FLG**3** is detected in step **47**, whereupon in steps **48** and **49** the pulse frequency F is modified pseudo randomly by a term proportional to B, every 4th cycle. Optionally, the amplitude of the image intensity pulsing may be modified as well, in similar fashion. Alternatively, the frequency and amplitude may be swept through an adjustable ramp, or according to any suitable schedule, in a manner known to those skilled in the art. The pulse variability may be applied to subliminal image intensity pulses.

When an image is displayed by a TV monitor in response to a TV broadcast, intensity pulses of the image may simply be imbedded in the program material. If the source of video signal is a recording medium, the means for pulsing the image intensity may comprise an attribute of recorded data. The pulsing may be subliminal. For the case of a video signal from a VCR, the pertinent data attribute is illustrated in FIG. 11, which shows a video signal record on part of a video tape **28**. Depicted schematically are segments of the video signal in intervals belonging to lines in three image frames at different places along the tape. In each segment, the chroma signal **9** is shown, with its short-term average level **29** represented as a dashed line. The short-term average signal level, also called the pseudo-dc level, represents the luminance of the image pixels. Over each segment, the level is here constant because the image is for simplicity chosen as having a uniform luminance over the screen. However, the level is seen to vary from frame to frame, illustrating a luminance that pulses slowly over time. This is shown in the lower portion of the drawing, wherein the IRE level of the short-term chroma signal average is plotted versus time. The graph further shows a gradual decrease of pulse amplitude in time, illustrating that luminance pulse amplitude variations may also be an attribute of the recorded data on the video tape. As discussed, pulsing the luminance for fixed chrominance results in pulsing of the image intensity.

Data stream attributes that represent image intensity pulses on video tape or in TV signals may be created when producing a video rendition or making a moving picture of a scene, simply by pulsing the illumination of the scene. This is illustrated in FIG. 12, which shows a scene **19** that is recorded with a video camera **18**, labelled “VR”. The scene is illuminated with a lamp **20**, labelled “LAMP”, energized by an electric current through a cable **36**. The current is modulated in pulsing fashion by a modulator **30**, labeled “MOD”, which is driven by a pulse generator **6**, labelled “GENERATOR”, that produces voltage pulses **35**. Again, pulsing the luminance but not the chrominance amounts to pulsing the image intensity.

The brightness of monitors can usually be adjusted by a control, which may be addressable through a brightness adjustment terminal. If the control is of the analog type, the displayed image intensity may be pulsed as shown in FIG. 15, simply by a pulse generator **6**, labeled “GEN”, that is connected to the brigthness adjustment terminal **88** of the monitor **2**, labeled “MON”. Equivalent action can be provided for digital brightness controls, in ways that are well known in the art.

The analog component video signal from a DVD player may be modulated such as to overlay image intensity pulses in the manner illustrated in FIG. **17**. Shown are a DVD player **102**, labeled “DVD”, with analog component video output comprised of the luminance Y and chrominance C. The overlay is accomplished simply by shifting the luminance with a voltage pulse from generator **6**, labeled “GENERATOR”. The generator output is applied to modulator **106**, labeled “SHIFTER”. Since the luminance Y is pulsed without changing the chrominance C, the image intensity is pulsed. The frequency and amplitude of the image intensity pulses can be adjusted respectively with the tuner **7** and amplitude control **107**. The modulator **105** has the same structure as the modulator of FIG. 2, and the pulse amplitude control **107** operates the potentiometer **15** of FIG. **2**. The same procedure can be followed for editing a DVD such as to overlay image intensity pulses, by processing the modulated luminance signal through an analog-to-digital converter, and recording the resulting digital stream onto a DVD, after appropriate compression. Alternatively, the digital luminance data can be edited by electronic reading of the signal, decompression, altering the digital data by software, and recording the resulting digital signal after proper compression, all in a manner that is well known in the art.

The mechanism whereby a CRT-type monitor emits a pulsed electromagnetic field when pulsing the intensity of an image is illustrated in FIG. **14**. The image is produced by an electron beam **10** which impinges upon the backside **88** of the screen, where the collisions excite phosphors that subsequently emit light. In the process, the electron beam deposits electrons **18** on the screen, and these electrons contribute to an electric field **3** labelled “E”. The electrons flow along the conductive backside **88** of the screen to the terminal **99** which is hooked up to the high-voltage supply **40**, labelled “HV”. The circuit is completed by the ground connection of the supply, the video amplifier **87**, labeled “VA”, and its connection to the cathodes of the CRT. The electron beams of the three electron guns are collectively shown as **10**, and together the beams carry a current J. The electric current J flowing through the described circuit induces a magnetic field **39**, labeled “B”. Actually, there are a multitude of circuits along which the electron beam current is returned to the CRT cathodes, since on a macroscopic scale the conductive back surface **88** of the screen provides a continuum of paths from the beam impact point to the high-voltage terminal **99**. The magnetic fields induced by the currents along these paths partially cancel each other, and the resulting field depends on the location of the pixel that is addressed. Since the beams sweep over the screen through a raster of horizontal lines, the spectrum of the induced magnetic field contains strong peaks at the horizontal and vertical frequencies. However, the interest here is not in fields at those frequencies, but rather in emissions that result from an image pulsing with the very low frequencies appropriate to sensory resonances. For this purpose a diffuse electron current model suffices, in which the pixel discreteness and the raster motion of the electron beams are ignored, so that the beam current becomes diffuse and fills the cone subtended by the displayed image. The resulting low-frequency magnetic field depends on the temporal changes in the intensity distribution over the displayed image. Order-of-magnitude estimates show that the low-frequency magnetic field, although quite small, may be sufficient for the excitation of sensory resonances in subjects located at a normal viewing distance from the monitor.

The monitor also emits a low-frequency electric field at the image pulsing frequency. This field is due in part to the electrons **18** that are deposited on the screen by the electron beams **10**. In the diffuse electron beam model, screen conditions are considered functions of the time t and of the Cartesian coordinates x and y over a flat CRT screen.

The screen electrons **18** that are dumped onto the back of the screen by the sum j(x,y,t) of the diffuse current distributions in the red, green, and blue electron beams cause a potential distribution V(x,y,t) which is influenced by the surface conductivity σ on the back of the screen and by capacitances. In the simple model where the screen has a capacitance distribution c(x,y) to ground and mutual capacitances between parts of the screen at different potentials are neglected, a potential distribution V(x,y,t) over the screen implies a surface charge density distribution

$q=Vc(x,y),$ (7)

and gives rise to a current density vector along the screen,

$j_s=-\sigma \mathrm{grad}_s V,$ (8)

where grad_s is the gradient along the screen surface. Conservation of electric charge implies

$j=c\dot{V}-\mathrm{div}_s(\sigma \mathrm{grad}_s V),$ (9)

where the dot over the voltage denotes the time derivative, and div_S is the divergence in the screen surface. The partial differential equation (9) requires a boundary condition for the solution V(x,y,t) to be unique. Such a condition is provided by setting the potential at the rim of the screen equal to the fixed anode voltage. This is a good approximation, since the resistance R_r between the screen rim and the anode terminal is chosen small in CRT design, in order to keep the voltage loss JR_r to a minimum, and also to limit low-frequency emissions.

Something useful can be learned from special cases with simple solutions. As such, consider a circular CRT screen of radius R with uniform conductivity, showered in the back by a diffuse electron beam with a spatially uniform beam current density that is a constant plus a sinusoidal part with frequency ∫. Since the problem is linear, the voltage V due to the sinusoidal part of the beam current can be considered separately, with the boundary condition that V vanish at the rim of the circular screen. Eq. (9) then simplifies to

V"+V"/r−i2π∫cn V=−Jη/A, r≦R, (10)

where r is a radial coordinate along the screen with its derivative denoted by a prime, η=1/σ is the screen resistivity, A the screen area, J the sinusoidal part of the total beam current, and i=(−1), the imaginary unit. Our interest is in very low pulse frequencies ∫ that are suitable for excitation of sensory resonances. For those frequencies and for practical ranges for c and η, the dimensionless number 2π∫cAη is very much smaller than unity, so that it can be neglected in Eq. (10). The boundary value problem then has the simple solution $V\ (r) = \frac{J\ \ \ \eta}{4\ \ \pi}\ (1-(r/R)^2).\ (11)$

$$V(r) = \frac{J\eta}{4\pi}(1-(r/R)^2). \qquad (11)$$

In deriving (**11**) we neglected the mutual capacitance between parts of the screen that are at different potentials. The resulting error in (**10**) is negligible for the same reason that the i2π∫cAη term in (**10**) can be neglected.

The potential distribution V(r) of (**11**) along the screen is of course accompanied by electric charges. The field lines emanating from these charges run mainly to conductors behind the screen that belong to the CRT structure and that are either grounded or connected to circuitry with a low impedance path to ground. In either case the mentioned conductors must be considered grounded in the analysis of charges and fields that result from the pulsed component J of the total electron beam current. The described electric field lines end up in electric charges that may be called polarization charges since they are the result of the polarization of the conductors and circuitry by the screen emission. To estimate the pulsed electric field, a model is chosen where the mentioned conductors are represented together as a grounded perfectly conductive disc of radius R, positioned a short distance δ behind the screen, as depicted in FIG. **16**. Since the grounded conductive disc carries polarization charges, it is called the polarization disc. FIG. 16 shows the circular CRT screen **88** and the polarization disc **101**, briefly called "plates". For small distances δ, the capacitance density between the plates of opposite polarity is nearly equal to ε/δ, where ε is the permittivity of free space. The charge distributions on the screen and polarization disc are respectively $εV(r)/δ+q_0$ and $−εV(r)/δ+q_0$, where the εV(r)/δ terms denote opposing charge densities at the end of the dense field lines that run between the two plates. That the part q_0 is needed as well will become clear in the sequel.

The charge distributions $εV(r)/δ+q_0$ and $−εV(r)/δ+q_0$ on the two plates have a dipole moment with the density

$D\ \ (r) = εV\ \ (r) = \frac{J\ \ \ \ ηε}{4\ \ \pi}\ \ (1-(r/R)^2),\ (12)$

$$D(r) = \epsilon V(r) = \frac{J\eta\epsilon}{4\pi}(1-(r/R)^2). \qquad (12)$$

directed perpendicular to the screen. Note that the plate separation δ has dropped out. This means that the precise location of the polarization charges is not critical in the present model, and further that δ may be taken as small as desired. Taking δ to zero, one thus arrives at the mathematical model of pulsed dipoles distributed over the circular CRT screen. The field due to the charge distribution q_0 will be calculated later.

The electric field induced by the distributed dipoles (12) can be calculated easily for points on the centerline of the screen, with the result $E\ \ (z) = \frac{V\ \ (0)}{R}\ \ \{2\ \ \rho/R - R/\rho - 2\ \ \ \ z\ \ /R\},\ (13)$

$$E(z) = \frac{V(0)}{R}\{2\rho/R - R/\rho - 2|z|/R\}. \qquad (13)$$

where V(**0**) is the pulse voltage (11) at the screen center, ρ the distance to the rim of the screen, and z the distance to the center of the screen. Note that V(**0**) pulses harmonically with frequency ∫, because in (11) the sinusoidal part J of the beam current varies in this manner.

The electric field (13) due to the dipole distribution causes a potential distribution V(r)/2 over the screen and a potential distribution of −V(r)/2 over the polarization disc, where V(r) is nonuniform as given by (11). But since the polarization disc is a perfect conductor it cannot support voltage gradients, and therefore cannot have the potential distribution −V(r)/2. Instead, the polarization disc is at ground potential. This is where the charge distribution q_0(r) comes in; it must be such as to induce a potential distribution V(r)/2 over the polarization disc. Since the distance between polarization disc and screen vanishes in the mathematical model, the potential distribution V(r)/2 is induced over the screen as well. The total potential over the monitor screen thus becomes V(r) of (**11**), while the total potential distribution over the polarization disc becomes uniformly zero. Both these potential distributions are as physically required. The electric charges q_0 are moved into position by polarization and are partly drawn from the earth through the ground connection of the CRT.

In our model the charge distribution q_0 is located at the same place as the dipole distribution, viz., on the plane z=0 within the circle with radius R. At points on the center line of the screen, the electric field due to the monopole distribution q_0 is calculated in the following manner. As discussed, the monopoles must be such that they cause a potential φ_0 that is equal to V(r)/2 over the disc with radius R centered in the plane z=0. Although the charge distribution q_0(r) is uniquely defined by this condition, it cannot be calculated easily in a straightforward manner. The difficulty is circumvented by using an intermediate result derived from Excercise 2 on page 191 of Kellogg (1953), where the charge distribution over a thin disc with uniform potential is given. By using this result one readily finds the potential φ*(z) on the axis of this disc as

$\varphi^*\ (z) = \frac{2}{\pi}\ V^*\ \beta\ (R_1),\ (14)$

$$\phi^*(z) = \frac{2}{\pi} V^* \beta(R_1). \qquad (14)$$

where $\beta(R_1)$ is the angle subtended by the disc radius R_1, as viewed from the point z on the disc axis, and V* is the disc potential. The result is used here in an attempt to construct the potential $\varphi_0(z)$ for a disc with the nonuniform potential V(r)/2, by the ansatz of writing the field as due to a linear combination of abstract discs with various radii R_1 and potentials, all centered in the plane z=0. In the ansatz the potential on the symmetry axis is written

$\varphi_0\ (z) = \alpha\ \ \beta\ (R) + b\ \int_0^R \beta\ (R_1)\ \ W,\ (15)$

$$\phi_0(z) = \alpha\beta(R) + b\int_0^R \beta(R_1)\,dW. \qquad (15)$$

where W is chosen as the function $1-R_1^{\ 2}/R^2$, and the constants a and b are to be determined such that the potential over the plane z=0 is V(r)/2 for radii r ranging from 0 to R, with V(r) given by (11). Carrying out the integration in (15) gives

$\varphi_0(z)=\alpha\beta(R)-b\{(1+z^2/R^2)\beta(R)-|z|/R\}.$ (16)

In order to find the potential over the disc r<R in the plane z=0, the function $\varphi_0(z)$ is expanded in powers of z/R for 0<z<R, whereafter the powers z^n are replaced by $r^n P_n(\cos\theta)$, where the P_n are Legendre polynomials, and (r,θ) are symmetric spherical coordinates centered at the screen center. This procedure amounts to a continuation of the potential from the z-axis into the half ball r<R, z>0, in such a manner that the Laplace equation is satisfied. The method is discussed by Morse and Feshbach (1953). The "Laplace continuation" allows calculation of the potential φ_0 along the surface of the disc r<R centered in the plane z=0. The requirement that this potential be V(r)/2 with the function V(r) given by (11) allows solving for the constants a and b, with the result

$a=-V(0)/\pi,\ b=-2V(0)/\pi.$ (17)

Using (17) in (16) gives $\varphi_0\ (z) = \frac{V\ (0)}{\pi}\ [(1+2\ \ z^2/R^2)\ \beta\ (R) - 2\ \ \ z\ \ /R],\ (18)$

$$\phi_0(z) = \frac{V(0)}{\pi}[(1+2z^2/R^2)\beta(R) - 2|z|/R]. \qquad (18)$$

and by differentiation with respect to z one finally finds

$$E_0(z) = \frac{V(0)}{\pi R}(z/|z|)[4-(R/\rho)^2-4\beta(R)|z|/R] \quad (19)$$

$$E_0(z)=\frac{V(0)}{\pi R}(z/|z|)[4-(R/\rho)^2-4\beta(R)|z|/R] \quad (19)$$

for the electric field on the center line of the screen brought about by the charge distribution $q_0(z)$.

The center-line electric field is the sum of the part (13) due to distributed pulsed dipoles and part (19) due to distributed pulsed monopoles. Although derived for circular screens, the results may serve as an approximation for other shapes, such as the familiar rounded rectangle, by taking R as the radius of a circle that has the same area as the screen.

For two CRT-type monitors the pulsed electric field due to image intensity pulsing has been measured at several points on the screen center line for pulse frequencies of ½ Hz. The monitors were the 15″ computer monitor used in the sensory resonance experiments mentioned above, and a 30″ TV tube. The experimental results need to be compared with the theory derived above. Since R is determined by the screen area, the electric fields given by (13) and (19) have as only free parameter the pulse voltage V(**0**) at the screen center. The amplitude of this voltage can therefore be determined for the tested monitors by fitting the experimental data to the theoretical results. Prior to fitting, the data were normalized to an image that occupies the entire screen and is pulsed uniformly with a 100% intensity amplitude. The results of the one-parameter fit are displayed in FIG. 18, which shows the theoretical graph **100**, together with the normalized experimental data points **103** for the 15− computer monitor and for the 30″ TV tube. FIG. 18 shows that the developed theory agrees fairly well with the experimental results. From the best fit one can find the center-screen voltage pulse amplitudes. The results, normalized as discussed above, are |V(0)|=266.2 volt for the 15″ computer monitor and |V(0)|=310.1 volt for the 30″ TV tube. With these amplitudes in hand, the emitted pulsed electric field along the center line of the monitors can be calculated from the sum of the fields (13) and (19). For instance, for the 15″ computer monitor with 1.8% RGB pulse modulation used in the ½ Hz sensory resonance experiments mentioned above, the pulsed electric field at the center of the subject, located at z=70 cm on the screen center line, is calculated as having an amplitude of 0.21 V/m. That such a pulsed electric field, applied to a large portion of the skin, is sufficient for exciting the ½ Hz sensory resonance is consistent with experimental results discussed in the '874 patent.

In deriving (**11**), the dimensionless number 2π∫cAη was said to be much smaller than unity. Now that the values for |V(0)| are known, the validity of this statement can be checked. Eq. (11) implies that |V(0)| is equal to η|J|/4π. The sum of the beam currents in the red, green, and blue electron guns for 100% intensity modulation is estimated to have pulse amplitudes |J| of 0.5 mA and 2.0 mA respectively for the 15″ computer monitor and the 30″ TV tube. Using the derived values for |V(0)|, one arrives at estimates for the screen resistivity η as 6.7 MΩ/square and 1.9 MΩ/square respectively for the 15″ computer monitor and the 30″ TV tube. Estimating the screen capacity cA as 7 pf and 13 pf, 2π∫cAη is found to be 148×10^{-6} and 78×10^{-6}, respectively for the 15″ computer monitor and the 30″ TV tube. These numbers are very small compared to unity, so that the step from (10) to (11) is valid.

The following procedures were followed in preparing pulsed images for the field measurements. For the 15″ computer monitor the images were produced by running the VB**6** program discussed above. The pulsed image comprised the full screen with basic RGB values chosen uniformly as R=G=B=127, with the exception of an on/off button and a few data boxes which together take up 17% of the screen area. The image intensity was pulsed by modifying the R, G, and B values by integer-rounded sine functions ΔR(t), ΔG(t), and ΔB(t), uniformly over the image, except at the button and the data boxes. The measured electric field pulse amplitudes were normalized to a pulsed image that occupies all of the screen area and has 100% intensity modulation for which the image pulses between black and the maximum intensity, for the fixed RGB ratios used. The image intensity depends on the RGB values in a nonlinear manner that will be be discussed. For the measurements of the pulsed electric field emitted by 30″ TV tube, a similar image was used as for the 15″ computer monitor. This was done by playing back a camcorder recording of the computer monitor display when running the VB**6** program, with 40% pulse modulation of R, G, and B.

In front of the monitor, i.e., for z>0, the parts (**13**) and (**19**) contribute about equally to the electric field over a practical range of distances z. When going behind the monitor where z is negative the monopole field flips sign so that the two parts nearly cancel each other, and the resulting field is very small. Therefore, in the back of the CRT, errors due to imperfections in the theory are relatively large. Moreover our model, which pretends that the polarization charges are all located on the polarization disc, fails to account for the electric field flux that escapes from the outer regions of the back of the screen to the earth or whatever conductors happen to be present in the vincinity of the CRT. This flaw has relatively more serious consequences in the back than in front of the monitor.

Screen emissions in front of a CRT can be cut dramatically by using a grounded conductive transparent shield that is placed over the screen or applied as a coating. Along the lines of our model, the shield amounts to a polarization disc in front of the screen, so that the latter is now sandwiched between to grounded discs. The screen has the pulsed potential distribution V(r) of (11), but no electric flux can escape. The model may be modified by choosing the polarization disc in the back somewhat smaller than the screen disc, by a fraction that serves as a free parameter. The fraction may then be determined from a fit to measured fields, by minimizing the relative standard deviation between experiment and theory.

In each of the electron beams of a CRT, the beam current is a nonlinear function of the driving voltage, i.e., the voltage between cathode and control grid. Since this function is needed in the normalization procedure, it was measured for the 15″ computer monitor that has been used in the ½ Hz sensory resonance experiments and the electric field measurements. Although the beam current density j can be determined, it is easier to measure the luminance, by reading a light meter that is brought right up to the monitor screen. With the RGB values in the VB**6** program taken as the same integer K, the luminance of a uniform image is proportional to the image intensity I. The luminance of a uniform image was measured for various values of K. The results were fitted with

$I=c_1 K^{\gamma}$, (20)

where c_1 is a constant. The best fit, with 6.18% relative standard deviation, was obtained for γ=2.32.

Screen emissions also occur for liquid crystal displays (LCD). The pulsed electric fields may have considerable amplitude for LCDs that have their driving electrodes on opposite sides of the liquid crystal cell, for passive matrix as well as for active matrix design, such as thin film technology (TFT). For arrangements with in-plane switching (IPS) however, the driving electrodes are positioned in a single plane, so that the screen emission is very small. For arrangements other than IPS, the electric field is closely approximated by the fringe field of a two-plate condenser, for the simple case that the image is uniform and extends over the full screen. For a circular LCD screen with radius R, the field on the center line can be readily calculated as due to pulsed dipoles that are uniformly distributed over the screen, with the result

$E_d(z)=(½)VR^2/(z^2+R^2)^{\{fraction\ (3/2)\}}$, (21)

where $E_d(z)$ is the amplitude of the pulsed electric field at a distance z from the screen and V is a voltage pulse amplitude, in which the aperture ratio of the LCD has been taken into account. Eq. (21) can be used as an approximation for screens of any shape, by taking R as the radius of a circle with the same area as the screen. The result applies to the case that the LCD does not have a ground connection, so that the top and bottom electrodes are at opposite potential, i.e., V/2 and −V/2.

If one set of LCD electrodes is grounded, monopoles are needed to keep these electrodes at zero potential, much as in the case of a CRT discussed above. The LCD situation is simpler however, as there is no charge injection by electron beams, so that the potentials on the top and bottom plates of the condenser in the model are spatially uniform. From (**14**) it is seen that monopoles, distributed over the disc of radius R in the plane z=0 such as to provide on the disc a potential V/2, induce on the symmetry axis a potential $\varphi\ (z) = \frac{1}{\pi}\ V\ \ \beta\ (R)$. (22)

$$\phi(z) = \frac{1}{\pi} V\beta(R). \qquad (22)$$

Differentiating with respect to z gives the electric field on the symmetry axis $E_m\ (z) = \frac{zVR}{z\ \ \pi\ (z^2+R^2)}$, (23)

$$E_m(z) = \frac{zVR}{|z|\pi(z^2+R^2)}. \qquad (23)$$

induced by the pulsed monopoles. For an LCD with one set of electrodes grounded, the pulsed electric field for screen voltage pulse amplitude V at a distance z from the screen on the center line has an amplitude that is the sum of the parts (21) and (23). The resultant electric field in the back is relatively small, due to the change in sign in the monopole field that is caused by the factor z/|z|. Therefore, screen emissions in front of an LCD can be kept small simply by having the grounded electrodes in front.

As a check on the theory, the pulsed electric field emitted by the 3″ LCD-TFT color screen of the camcorder mentioned above has been measured at eleven points on the center line of the screen, ranging from 4.0 cm to 7.5 cm. The pulsed image was produced by playing back the video recording of the 15″ computer monitor that was made while running the VB**6** program discussed above, for a image intensity pulse frequency of ½ Hz, R=G=B=K, modulated around K=127 with an amplitude

ΔK=51. After normalization to a uniform full screen image with 100% intensity modulation by using the nonlinear relation (20), the experimental data were fitted to the theoretical curve that expresses the sum of the fields (21) and (23). The effective screen pulse voltage amplitude V was found to be 2.1 volt. The relative standard deviation in V for the fit is 5.1%, which shows that theory and experiment are in fairly good agreement.

Certain monitors can cause excitation of sensory resonances even when the pulsing of displayed images is subliminal, i.e., unnoticed by the average person. When checking this condition on a computer monitor, a problem arises because of the rounding of RGB values to integers, as occurs in the VB**6** program. For small pulse amplitude the sine wave is thereby distorted into a square wave, which is easier to spot. This problem is alleviated somewhat by choosing ΔR=0, ΔG=0, and ΔB=2, since then the 8 rounded sine functions around the unit circle, multiplied with the pulse amplitude ΔB=2 become the sequence 1, 2 11 2, 1, −1 −2, −2, −1, etc, which is smoother to the eye than a square wave. Using the VB**6** program and the 15″ computer monitor mentioned above with R=71, G=71, and B=233, a ½ Hz pulse modulation with amplitudes ΔR=ΔG=0 and ΔB=2 could not be noticed by the subject, and is therefore considered subliminal. It is of interest to calculate the screen emission for this case, and conduct a sensory resonance experiment as well. A distance z=60 cm was chosen for the calculation and the experiment. Using Eq. (20), the image intensity pulse modulation for the case is found to be 1.0% of the maximum intensity modulation. Using R=13.83 cm together with |V(0)|=266.2 V for the 15″ computer monitor, and the theoretical graph **100** of FIG. 18, the pulsed electric field at z=60 cm was found to have an amplitude of 138 mV/m. In view of the experimental results discussed in the '874 and '922 patents, such a field, used at a pulse frequency chosen appropriately for the ½ Hz sensory resonance and applied predominantly to the face, is expected to be sufficient for exciting the ½ Hz sensory resonance. A confirmation experiment was done by running the VB**6** program with the discussed settings and the 15″ monitor. The center of the subject's face was positioned on the screen center line, at a distance of 60 cm from the screen. A frequency sweep of −0.1% per ten cycles was chosen, with an initial pulse frequency of 34 ppm. Full ptosis was experienced by the subject at 20 minutes into the run, when the pulse frequency was f=31.76 ppm. At 27 minutes into the run, the frequency sweep was reversed to +0.1% per ten cycles. Full ptosis was experienced at f=31.66 ppm. At 40 minutes into the run, the frequency sweep was set to −0.1% per ten cycles. Full ptosis occurred at f=31.44 ppm. The small differences in ptosis frequency are attributed to chemical detuning, discussed in the Background Section. It is concluded that the ½ Hz sensory resonance was excited in this experiment by screen emissions from subliminal image pulsing on the 15″ computer monitor at a distance of 60 cm. For each implementation and embodiment discussed, the image pulsing may be subliminal.

The human eye is less sensitive to changes in hue than to changes in brightness. In composite video this fact allows using a chrominance bandwidth that is smaller than the luminance bandwidth. But it also has the consequence that pulsing of the chrominance for fixed luminance allows larger pulse amplitudes while staying within the subliminal pulse regime. Eq. (3) shows how to pulse the chrominance components R-Y and B-Y while keeping Y fixed; for the change in pixel intensity one then has

$$\Delta I_h = 0.491\Delta(R\text{-}Y) + 0.806\Delta(B\text{-}Y). \qquad (24)$$

Luminance pulses with fixed chrominance give a change in pixel intensity

$$\Delta I_1 = 3\Delta Y. \qquad (25)$$

Of course, pure chrominance pulses may be combined with pure luminance pulses; an instance of such combination has been mentioned above.

The subliminal region in color space needs to be explored to determine how marginally subliminal pulses ΔR, ΔG, and ΔB depend on RGB values. Prior to this, the condition for image pulses to be subliminal should not be phrased solely in terms of the percentage of intensity pulse amplitude. The subliminal image pulsing case considered above, where the monitor is driven by a VB**6** computer program with R=G=71, B=233, and ΔR=ΔG=0, ΔB=2 for full-screen images will be referred to as “the standard subliminal image pulsing”.

In the interest of the public we need to know the viewing distances at which a TV with subliminally pulsed images can cause excitation of sensory resonances. A rough exploration is reported here which may serve as starting point for further work. The exploration is limited to estimating the largest distance $z=z_{max}$ along the center line of the 30″ TV at which screen emissions can excite the ½ Hz resonance, as determined by the ptosis test. The TV is to display an image which undergoes the standard subliminal pulsing as defined above. It would be best to perform this test with the 30″ TV on which the subliminally pulsed images are produced by means of a video. Since such a video was not available, the ptosis test was conducted instead with a pulsed electric field source consisting of a small grounded doublet electrode of the type discussed in the '874 patent. The doublet was driven with a sinusoidal voltage of 10 V amplitude, and the center of mass of the subject was located on the center line of the doublet at a distance $z=z_d=323$ cm. The doublet electrodes are rectangles of 4.4 cm by 4.7 cm. At the large distance z_d there is whole-body exposure to the field, so that the bulk effect discussed in the '874 patent comes into play, as is expected to happen also at the distance z_{max} from the 30″ TV monitor. The subject was facing the "hot" electrode of the doublet, so that at the subject center the electric field was the sum of the parts (21) and (23), for positive values of z. It was thought important to use a sine wave, since that would be the "commercially" preferred pulse shape which allows larger pulse amplitudes without being noticed. The only readily available sine wave generator with the required voltage was an oscillator with a rather coarse frequency control that cannot be set accurately, although the frequency is quite stable and can be measured accurately. For the experiment a pulse frequency of 0.506 Hz was accepted, although it differs considerably from the steady ptosis frequency for this case. The subject experienced several ptosis cycles of moderate intensity, starting 8 minutes into the experiment run. It is concluded that the ½ Hz sensory resonance was excited, and that the stimulating field was close to the weakest field capable of excitation. From Eqs. (21) and (23), the electric field pulse amplitude at the center of mass of the subject was found to be 7.9 mV/m. That an electric field with such a small pulse amplitude, applied to the whole body, is capable of exciting the ½ Hz sensory resonance is consistent with experimental results reported in the '874 patent, although these were obtained for the 2.4 Hz resonance. Next, the distance z_{max} was determined at which the 30″ TV tube with 1% image intensity pulse amplitude produces an electric field with a pulse amplitude of 7.9 mV/m, along the center line of the screen. From Eqs. (13) and (19) one finds $z_{max}=362.9$ cm. At more than 11 feet, this is a rather large distance for viewing a 30″ TV. Yet, the experiment and theory discussed show that the ½ Hz sensory resonance can be excited at this large distance, by pulsing the image intensity subliminally. Of course, the excitation occurs as well for a range of smaller viewing distances. It is thus apparent that the human nervous system can be manipulated by screen emissions from subliminal TV image pulses.

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The invention is not limited by the embodiments shown in the drawings and described in the specification, which are given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

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LEGAL EVENTS

Date	Code	Event	Description
Jul 9, 2006	FPAY	Fee payment	**Year of fee payment:** 4
Jun 13, 2010	FPAY	Fee payment	**Year of fee payment:** 8
May 25, 2014	FPAY	Fee payment	**Year of fee payment:** 12