One can avoid the described physiological responses by wearing snugly fitting ear plugs. This shows that the excitation occurs via the external ear canal, so that the stimulation proceeds either through the auditory nerve or the vestibular nerve. Frequencies near ½ Hz or 2.5 Hz are far too low for stimulating the cochlear apparatus, but they are within the response range of hair cells in the vestibular end organ. Also, there exists a low-frequency acoustic path to the vestibular end organ by virtue of the ductus reuniens which provides a fluid connection between the cochlea and the vestibular organ. The narrow duct severely attenuates acoustic signals and acts as a low pass filter with a very low cutoff frequency. Subaudio acoustic signals, i.e., acoustic signals with frequencies up to 15 Hz, may perhaps penetrate to the vestibular organ with sufficient strength for stimulating the exquisitely sensitive vestibular hair cells.

For the ½ Hz and 2.5 Hz resonances, the described physiological responses are observed only if the acoustic intensity lies in a certain interval, called the effective intensity window. The acoustic intensity levels in this window are far below the human auditory threshold, so that exposed subjects do not sense the acoustic pulses in any other way than through the mentioned physiological effects. The upper limit of the effective intensity window is believed to be due to nuisance-guarding neural circuitry that blocks repeditive nuisance signals from higher processing.

The acoustic signals used for the excitation of sensory resonances have the nature of pulses. The pulses may be square, trapezoid, or triangle, or rounded versions of these shapes. However, depending on the pulse frequency, strong harmonics with frequencies in the audible range could stimulate the cochlear apparatus. This may be avoided by using sine waves or appropriately rounded other waves with low harmonic content.

The acoustic pulses occur in the atmosphere air; even when administered with earphones, the pulses at the subject's ear constitute pressure and flow pulses in the local atmospheric air.

The resonance frequencies of the ½ Hz and 2.5 Hz sensory resonances lie respectively near ½ and 2.5 Hz. The different physiological effects mentioned occur at slightly different frequencies. Thus, one can tune for drowsiness or sexual excitement, as desired. The precise resonance frequency is also expected to depend slightly on the subject and the state of the nervous and endocrine systems, but it can be measured readily by tuning the acoustic pulse frequency for maximum physiological effect. Besides the resonances near ½ and 2.5 Hz, other sensory resonances may perhaps be found, and those with resonance frequencies below 15 Hz are expected to be excitable acoustically via the vestibular nerve, since the vestibular hair cells are sensitive in this frequency range.

The finding that deeply subliminal subaudio acoustic stimulation can influence the central nervous system suggests a method and apparatus for manipulating the nervous system of a subject by inducing subliminal atmospheric acoustic pulses of subaudio frequency at the subject's ears. In doing so, one may in addition exploit the sensory resonance mechanism, but there are important applications where this is not done. For example, the subliminal acoustic manipulation of the nervous system may be used clinically for the control of tremors and seizures, by detuning the pathological oscillatory activity of neural circuits that occurs in these disorders. This may be done by choosing an acoustic frequency that is slightly different from the frequency of the pathological oscillation. The evoked neural signals then cause phase shifts which may diminish or quench the oscillation. Exploitation of the resonance mechanism by tuning the acoustic signals to the resonance frequency of a selected sensory resonance affords other forms of manipulation, such as control of insomnia and anxiety, or facilitation of sexual arousal.

For both types of manipulation, the required subliminal subaudio acoustic pulses may be induced at one or both of the subject's ears by earphones with a proper low-frequency response, acoustic waves generated by an acoustic source and propagated through the atmosphere, or by a pulsed jet of gas (which may be air), preferably directed at a material surface open to the atmosphere, such as a wall or the subject's skin or clothing. In the area of impact, especially where the surface is oriented substantially perpendicular to the jet, atmospheric pressure pulses are then generated by virtue of the ram effect, wherein flow velocity fluctuations are wholly or partly converted into static pressure fluctuations. If the material surface on which the jet impinges includes the subject's ears, then these pressure pulses cause direct stimulation of the subject, but the pulses also propagate through the atmosphere to the subject's ears by virtue of acoustic wave propagation along accessible paths.

The induction of atmospheric acoustic pulses by a pulsed air jet proceeding in the atmosphere and directed at a subject is shown in FIG. **1**, where a blower **1**, labeled "FAN", produces an air jet **2** that is directed at a subject **3**. The fan is powered by a power supply **4**, labelled "SUPPLY". At the fan, the supply voltage is modulated in pulsed fashion by a relay **5** controlled by the generator **6**, labelled "GENERATOR", through voltage pulses **7** supplied to electromagnet windings **8**. A user can adjust the frequency of the pulses with the tuning control **9**. The pulsing of the voltage supplied to the fan causes the momentum flux **10** of the air jet to be modulated in a pulsed manner. Upon impinging on a material surface such as the skin of the subject **3**, the pulsed jet induces acoustic pressure pulses at the ears **11** of the subject. The atmospheric acoustic effect of the jet is complicated by the fact that the region of the fan inlet undergoes a fluctuation of static pressure as the result of the modulation of jet momentum flux. There thus are two distinct acoustic monopoles, one at the fan inlet and the other in the area of impact of the jet on the material surface. The monopoles radiate with a phase difference that is determined by the jet velocity, the modulation frequency, and the distance between fan and impact area. The resulting sound pressure at the subject's ears can be analyzed with retarded potentials as discussed for instance by Morse and Feshbach (1953). Even a jet which does not impinge on a material surface radiates by virtue of the acoustic monopole at the fan inlet.

When skin of the subject is exposed to gas flow of the jet, or to the flow of atmospheric air entrained by the jet, the flow will fluctuate in pulsed fashion, so that a periodic heat flux occurs by convective transport and evaporation of sweat. The resulting periodic fluctuation of the skin temperature can excite a sensory resonance, as discussed in U.S. Pat. No. 5,800,481, Sep. 1, 1998. Hence, the apparatus of FIG. **1** can cause excitation of a sensory resonance via two separate sensory pathways, viz., the vestibular nerve and the afferents from cutaneous temperature receptors. The strength of the thermal stimulation depends on the skin area and type of skin exposed to the fluctuating flow. The face is particularly sensitive, especially the lips. The two-channel excitation of sensory resonances needs further investigation. In any particular situation, the vestibular channel can be blocked by using earplugs.