

## Cough Stimulation Device (Yeda)

**code:** T4-1574

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### Summary

Spinal cord injuries (SCI) patients are deprived from using their abdominal muscles in order to facilitate an efficient cough and clear their airways. Functional Electric Stimulation (FES) may provide the abdominal contraction that is required; however, in order for such a device to fully substitute the help of a caregiver, it must be easily activated and precisely synchronized with the patient's intent to cough in order to replace the voluntary cough.

The present inventors present a device, which integrates nasal air signals, in the form of active sniff, with triggering of FES at a precisely timed onset following glottis closure. Tetraplegic patients that used this system produced a cough that is comparable to a physiotherapist-assisted cough and reported a major improvement in quality of life.

This device offers a fresh approach to cough assistance which combines superior comfort and efficiency, perfectly adjusted to the needs of spinal cord trauma.

### Applications

Self controlled - enables quality of life, independence, intimacy.

Simple, compacted and portable.

Enables "smart coughing" - a patient's needs or commands are used to modify parameters synchronizing the cough.

Nasal air sensors are considered less intrusive and more reliable, than currently used mouth air sensors.

Potentially low cost system.

### Advantages

Intuitive and easy to learn and control for any computer user.

Simultaneous use of different controllers to improve and diversify gaming applications.

Non-invasive and safe device

### Technology's Essence

The microcontroller receives analog inputs from pressure sensors and is programmed to trigger the FES. A command to cough from the patient may be two consecutive sniffs (nasal air signals). In addition, the system can potentially identify intent to cough using nasal air signals, without the need for a direct command. One of the most important parameters of the invention is that the FES will be given during glottis closure. The system continuously samples the nasal air signal and defines glottis closure as a plateau in the signal. A machine learning element determines a typical glottis closure duration for each patient, providing the FES within this time frame. The FES is then given to the abdomen in order to facilitate coughing. The duration of the FES may be determined by a feedback which may be a value of emitted CO<sub>2</sub>, value of EMG, volume of sounds etc. Finally, the device may be further down-sized to enable mobility and suit outdoor use.

#### Contact for more information:

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