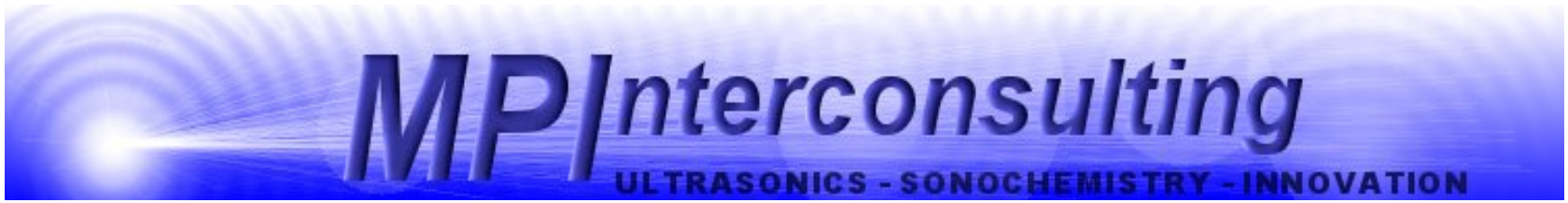
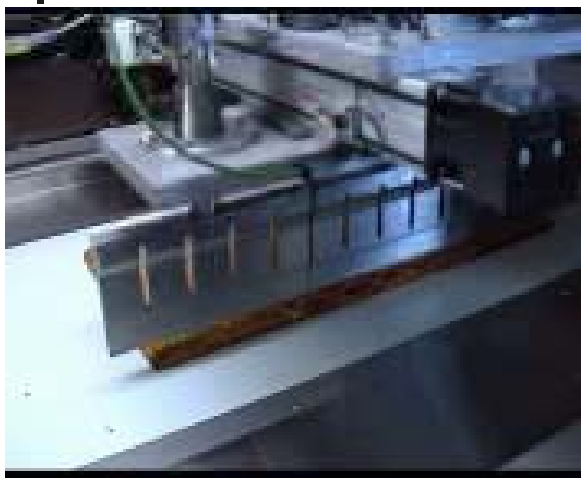
Multifrequency Ultrasonic Cutting

Main Web Site: http://www.mpi-ultrasonics.com
Download Server: http://mastersonic.com
Email: mpi@bluewin.ch



Traditional Ultrasonic Cutting

(examples from different Internet sources)



Movie files:
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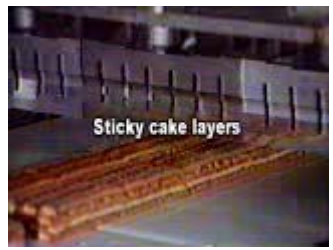
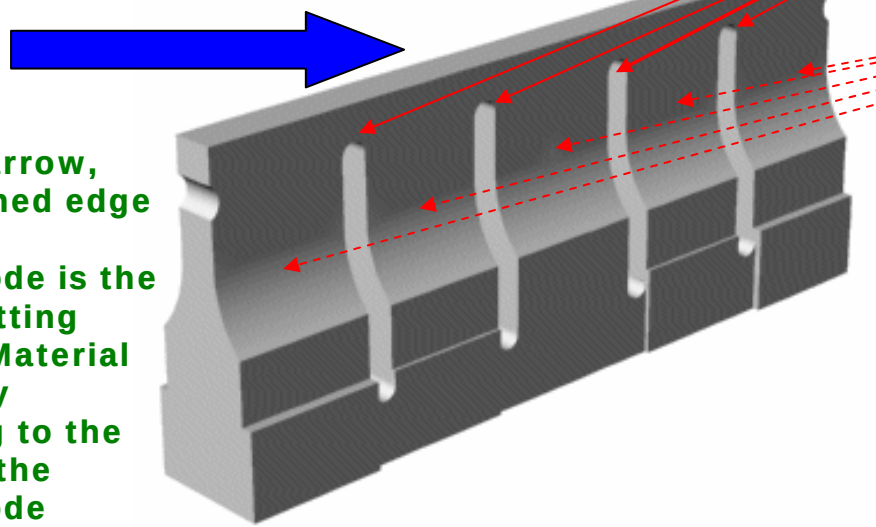
In reality:
Slightly Modified, Constant Frequency Ultrasonic Plastic Welding Equipment



Known Problems of existing Ultrasonic Cutting Equipment (constant frequency operating)

Ultrasonic plastic welding sonotrode, sharpened here



Very narrow, sharpened edge of the sonotrode is the only cutting zone. Material is easily sticking to the rest of the sonotrode surface

-Sonotrodes are easily braking (here around slots)

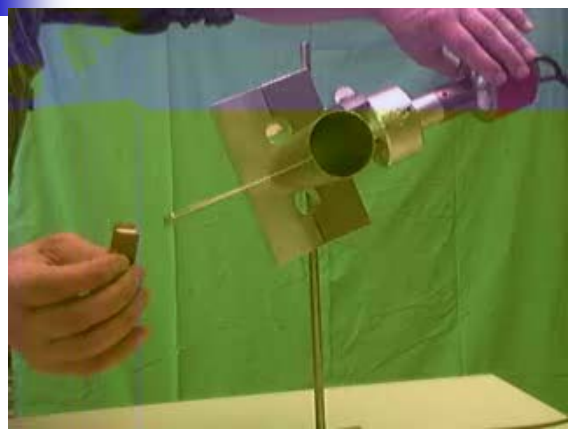
-Material is sticking to a sonotrode (here)

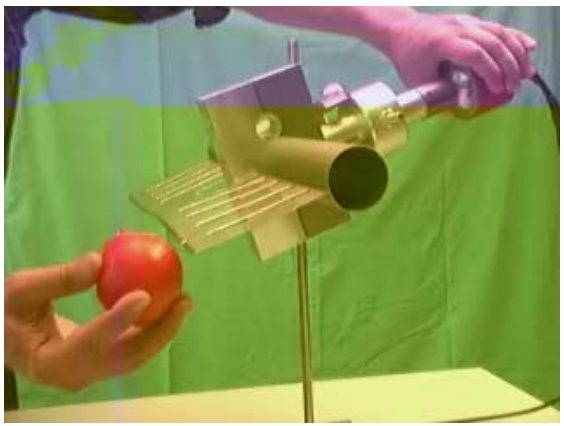
-Sonotrodes are complex and expensive

-The best cutting zone is very narrow (more than 90 % of the sonotrode surface is inefficient for cutting)

MMM-Multifrequency Cutting

(4 movie files on this page)

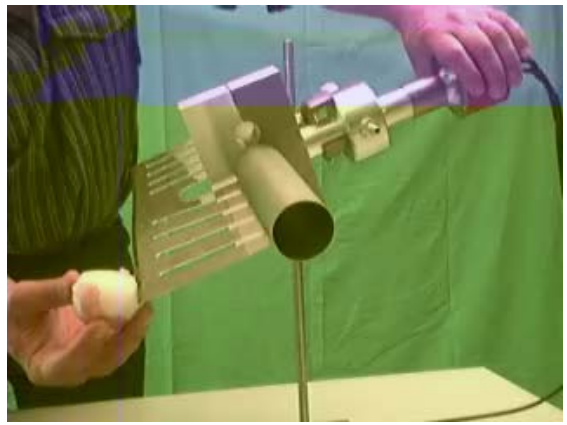




-Food products cutting

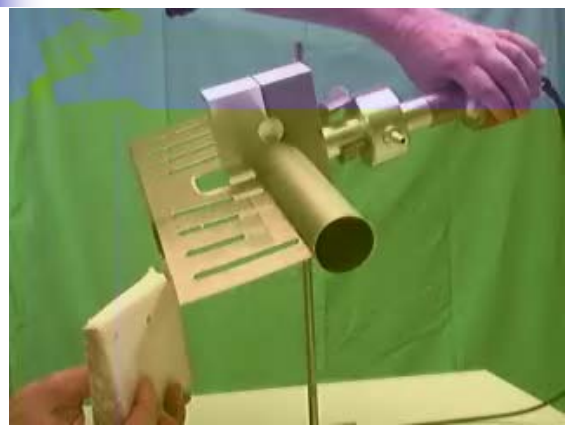
-Large and fully activated cutting blade

-No standing waves



Multifrequency Cutting Examples

(4 movie files on this page)

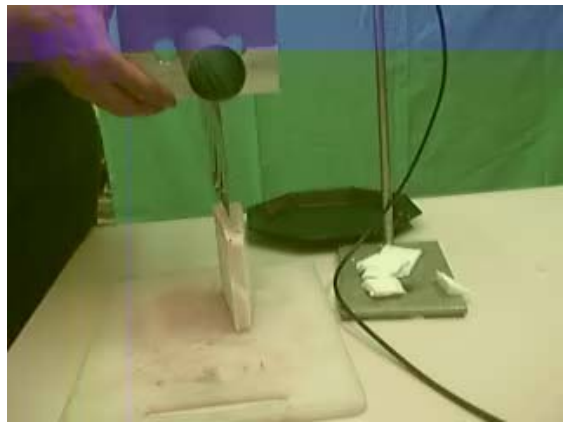


-Sonotrodes are uniformly activated (90% of the sonotrode surface is fully efficient for cutting)

-Material is not sticking to a sonotrode

-Sonotrodes are very simple and inexpensive

-The best cutting zone is very large (no standing waves)



Multifrequency Cutting Design (MMM technology)

Number of New Design Options

Feasible: **MPI's R&D In Process…**

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(54) Multifrequency ultrasonic structural actuators

(57) The propagation of ultrasonic energy in arbitrary shaped solid structures (D), heavy and very-thick-walls metal containers, pressurized reservoirs, very-thick metal-walls autoclaves, in different mechanical oscillating structures and systems,... is realized using a novel ultrasonic structural, multifrequency actuator (including very particular multifrequency ultrasonic power supply, also the subject of this invention), able to initiate ringing and relaxing, multimode mechanical oscillations (harmonics and sub harmonics) in any heavy-duty, bulky and rigid system, producing pulse-repetitive, phase, frequency and amplitude-modulated bulk-wave-excitation (covering and sweeping extremely large frequency area). Such ultrasonic driving is creating uniform and homogenous distribution of acoustical activity on a surface and inside of the vibrating system, while avoiding creation of stationary and standing waves structure, making that the complete vibrating system is fully agitated. Multifrequency ultrasonic structural actuator is ideal for agitating arbitrary distant and arbitrary shaped liquid and solid masses placed in different open or pressurized vessels, containers, autoclaves, reservoirs and pipes, transferring vibrations via wave-guide solid rod fixed betweem the transducer and a loading mass (where loading mass presents an oscillating body, and/or oscillating vessel, autoclave, container...). This invention presents an extension and continuation of the previous patent, originating from the same Author/Inventor (see 1 060 789 A1), explaining the additional aspects of particular electronics necessary to drive ultrasonic transducers in a multifrequency and multi-mode oscillating regime/s, while keeping high efficiency of electric and ultrasonic energy transfer and/or transformation. Fields o f possible applications related to this invention are: Ultrasonic Cleaning, Welding,Material Processing, Sonochemistry, Liquid Metals treatment, Atomization, Materials Testing, Aging and Stress Release, Homogenization, Process Industry, etc.

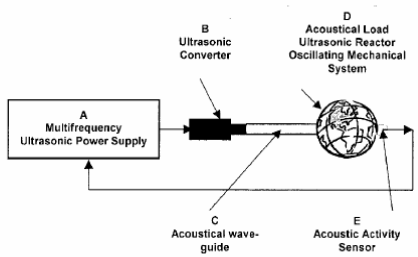

Fig. 1 Block Diagram of a Multifrequency Structural Actuator

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MMM *(**M**odulated, **M**ultimode, **M**ultifrequency) ultrasonic generators utilize a new and proprietary technology capable of stimulating wideband sonic and ultrasonic energy, ranging in frequency from infrasonic up to the MHz domain, that propagates through arbitrary shaped solid structures. Such industrial structures may include heavy and thick walled metal containers, pressurized reservoirs, very thick metal walled autoclaves, extruder heads, extruder chambers, mold tools, casting tools, large mixing & cutting probes, various solid mechanical structures, contained liquids, and ultrasonic cleaning systems.*