

# Electronic Noise Cancellation

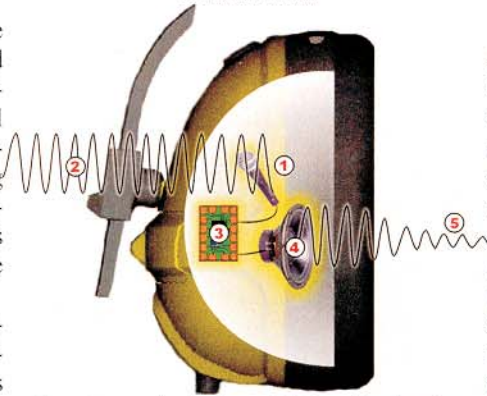
## A New Horizon For Hearing Protection

By JOANNA LIPPER

**Technological developments** over the past 50 years have dramatically changed the way humans live, work and communicate. However, in the world of personal protective equipment, things have remained pretty much static. For hearing safety, workers are offered passive ear defenders in the form of earplugs or earmuffs that employ acoustic foam to block noise waves from entering the ear.

For mid- and high-frequency noise protection, passive ear defenders are quite effective; however, that effectiveness is diminished in the lower frequencies. Noise generated by engines, motors and fans is prevalent in many industrial environments and these noise waves are longer, can travel great distances and can penetrate passive barriers—even cement walls.

Electronic Noise Cancellation (ENC),



also termed Active Noise Reduction (ANR), Active Noise Cancellation (ANC) or “anti-noise,” is the most effective and efficient method of attenuating low-frequency noise. ENC is achieved by electronically coupling a noise wave with its exact mirror image wave, thereby neutralizing the noise.

ENC has been applied in the military and aviation markets for many years. Aircraft cabin noise, for example, which can be detrimental to the intelligibility of communications, is well within the effective range of ENC, and therefore most aviation headsets incorporate the technology.

Although commonplace in the aviation, military and consumer worlds, electronic noise cancellation has not been widely available to the industrial worker. This is now beginning to change with cost effective ENC earmuffs, priced in the \$149 range, that are self-contained, conveniently powered and relatively lightweight.

The objective of an ENC earmuff is to provide the most complete hearing protection across all noise frequencies, and therefore the device combines electronic noise cancellation (Continued on page 20)

# Spending too much time managing your hearing test data?

## Simplify.



# www.AudioAssessor.com

Web-based Audiometric Data Management



800-717-3472

CIRCLE 10 ON READER SERVICE CARD

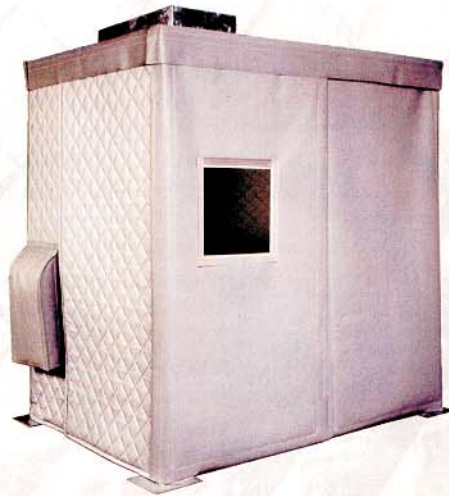


# WE WANT TO BE YOUR SILENT PARTNER

- Modular Construction
- 20 Db(a) Reductions
- Economically Priced
- Easy To Assemble

**Barricade**  
NOISE CONTROL PRODUCTS

## Acoustical Machine Enclosures



LOCAL DISTRIBUTORS • NATIONWIDE SUPPORT

**SOUND SEAL**

www.soundseal.com • 1-800-569-1294

CIRCLE 18 ON READER SERVICE CARD

# RUB OUT ACCIDENTS!



These cards have helped ExxonMobil, Marriott, Coca-Cola, International Paper and thousands of others lower their accidents by an average of **61.9%**.

This fun incentive program:

1. is easy to administer,
2. includes all awards,
3. is behavior based.

Learn what everyone is talking about. It's time you rub out accidents.



Call now for your **FREE Safety Jackpot kit.**  
**1-800-235-2495**

Complete or staple to business card. **Mail to:** Peavey, 10749 W. 84th Terr., Lenexa, KS 66214

**Yes!** Please send my FREE Safety Jackpot Kit TODAY. FSMA03/06

Name \_\_\_\_\_ Company \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Phone \_\_\_\_\_

Fax \_\_\_\_\_ Email \_\_\_\_\_ # Participating Employees \_\_\_\_\_

CIRCLE 17 ON READER SERVICE CARD

## Electronic Noise...

(Continued from page 19)

of the low frequencies with a traditional passive muff for dampening mid and high frequencies.

Currently available anti-noise earmuffs deliver approximately 20dB of electronic noise cancellation within the 20-800 Hz range. For the most complete hearing protection, these earmuffs also deliver a passive noise reduction rating (NRR) of as high as 26. Additionally, some versions feature an audio input so that workers who are allowed to listen to music on the job can listen at safe volume levels.

## Technology

An ENC system typically is comprised of a microphone, processing electronics and a speaker. The microphone senses the undesired sound wave and transmits that information to the processing electronics where the wave signature is analyzed. The processing electronics then create an inverse noise wave called "anti-noise" and, via the output speaker, couple the anti-noise wave with the original sound wave. If a perfect coupling of the opposing waves were to be achieved, the result would be absolute silence. Most frequently, however, because perfection is not realistic, the result is a substantial reduction of noise.

## Low-frequency Noise Exposure

In addition to hearing loss, prolonged exposure to noise, including low-frequency noise, is known to cause fatigue, reduced productivity, headaches and even high blood pressure. Additionally, low-frequency noise is particularly detrimental to communication because it masks consonant sounds — the sounds that make speech intelligible. In environments where there is an abundance of low-frequency noise, people express the ability to hear another speaking, but not to understand what is being said.

Low-frequency noise from engines, motors and fans dominates many industrial settings. Some of the loudest work environments include airfields, forestry, pay loaders, diesel locomotives, forges, factories, highways, ship engine rooms and heavy tractors. Communication in these environments is often crucial, and, therefore, low-frequency noise reduction is a necessity.

## The Passive/Electronic Combination

Passive noise control methods absorb noise and vibration energy and control its propagation with sound absorbing and rigid materials. This is an effective ap-



proach at high frequencies; however, below 500 Hz the cost, weight and mass of passive sound attenuation often make this approach ineffective or impractical.

While ENC systems can succeed within the full range of sound frequencies, most of the systems commercialized to date have dealt with low frequency sounds because noise of this type cannot be controlled in any other way.

Because environmental noise usually encompasses a wide frequency range, it is often necessary to combine electronic and passive methods to achieve optimal performance. This is the reason that in most ENC systems there is a passive element to reduce the mid- to high frequencies.

### Hearing Protection

Most currently available hearing protection products are passive earplugs and earmuffs. The measure of effectiveness for passive hearing protectors, the Noise Reduction Rating (NRR) has been criticized as overstating the level of noise protection a worker receives. Extensive research shows that, on average, ear plugs yield only 25 percent of their rated values and earmuffs yield only 60 percent of their rated values in the field. This is largely due to human error such as the improper insertion of earplugs and wear and tear on the clamping force and ear seals of earmuffs.

Even with optimally performing passive hearing protectors, however, low-frequency noise permeates and reaches the ears. The most complete hearing protection currently available to workers is a device that combines electronic and passive noise control methods. The illustration on page 19 shows a cross section of an electronic noise-canceling earmuff.

This type of earmuff uses a microphone inside the ear cup (1) to listen to noise coming into the ear (2). Using electronics (3), the system takes that information and uses it to create a noise wave that is identical to, but directly opposite of, the one coming into the ear. The "anti-noise" wave is output through a speaker (4), also located in the ear cup. When the two waves (the noise wave and the anti-noise wave) meet, the noise is significantly reduced (5).

ENC is a true technological breakthrough in industrial hearing protection because it remedies the noise problems that previously had no solution. There have been no signif-

icant advances in passive hearing protection, as passive is well understood and has been fully exploited. Currently available ENC earmuffs are lightweight, high-performing and low-cost. As hearing loss continues to be a problem and noise standards become more stringent, it is expected that advanced hearing protection will be more widely adopted, and even

required in certain noise environments. **FSM**

*Joanna Lipper is director of Marketing Communications of Pro Tech Communications, Inc., manufacturer of the NoiseBuster Electronic Noise Canceling Safety Earmuff. The company is located in Fort Pierce, FL and Westport, CT. Call 203-226-4447 ext. 3506, www.noisebuster.net.*

# Don't Gamble With Your Fire Protection



## HALOTRON® I CLEAN AGENT

- Clean (no residue)
- ABC rated
- Safe
- Available in more than 20 UL Listed Portable and Wheeled Extinguishers
- US FAA approved for Airport Ramp and On-Board Use
- Installed in 300-500 lb. systems at more than 55 Commercial Airports

*Distributed in Equipment Manufactured By:*



**Amerex Corporation, USA**  
Tel. 205-655-3271, Fax 205-655-3279



**Badger Fire Protection, USA**  
Tel. 800-446-3857, Fax 434-973-1589



**Buckeye Fire Equipment, USA**  
Tel. 704-739-7415, Fax 704-739-7418



**Kidde Safety, USA**  
Tel. 800-654-9677, Fax 800-547-2111



**Oshkosh Truck, USA**  
Tel. 920-233-9400, Fax 920-233-9670



**E-ONE Inc., USA**  
Tel. 352-237-1122, Fax 352-237-1161



**Fire Combat Inc., USA**  
Tel. 715-735-9058, Fax 715-735-7223



**AMEREX**



**BADGER**



**KIDDE**



**BUCKEYE**

*Also available from: Palmer Asia (Philippines), Mafavegos Donny (Argentina), Lingjack (Singapore), Haseen Habib (Pakistan), SFFECO (Saudi Arabia), Korean Pacific Corporation (Korea), PT Indolok Bakti Utama (Indonesia) and others.*

Halotron® II Clean Agent is available from Sprinklerhuset (Sweden).

**American Pacific Corporation, Halotron Division**  
LAS VEGAS, NEVADA / CEDAR CITY, UTAH, USA  
702-735-2200 • FAX 702-735-4876 • WEB: halotron-inc.com • E-MAIL: halotron@apfc.com

\*HALOTRON® IS A REGISTERED TRADEMARK OF AMERICAN PACIFIC CORPORATION

CIRCLE 8 ON READER SERVICE CARD