American Optical Co. Turns Its Eyes on Ears to Aid

By FRANK TIVNAN, JR.

SOUTHBRIDGE—The American Optical Co. here, since 1833 a pioneer in protecting man's vision and a leader in modern optical technology, has now applied its knowledge to protecting man's hearing.

It will market "in the near future" an acoustical development to cope with noise related dangers to hearing. These already are costing American industry $22 million daily in workmen's compensation.

The innovation, called "ear protectors" appears to resemble a pair of elaborate earmuffs. This headset however, performs the dual function of reducing to tolerable minimums loud noises from engines or machines and of enabling workmen to engage in normal conversation without strain.

Hearing at Stake

The need for a comfortable and safe hearing protector has long been noted by industry and the military. An Air Force expert says that daily exposure for 10 seconds to certain types of noises will eventually cost a man his hearing. And a national insurance company has received a claim totaling $1.3 million from a single drop-forge plant in Wisconsin for hearing damage to its employes.

"But we should be ahead of the need," notes Fred P. Beguin, 52, a German-born acoustics engineer who heads AO's electroacoustics section.

"Not only in industry but on aircraft carriers and battleships especially for gunners who can quickly have their hearing damaged. Hearing here is a well-known problem."

This acoustics marvel that blocks out loud noises while admitting speech waves, is formed of two special plastic cups that fit snugly over the ears. The precise composition of this plastic is an AO secret.

Inside is a foam substance that absorbs loud sound waves while permitting others to penetrate. The ear cups are carefully curved to match comfortably the contours of most heads.

"The challenge is to keep the inside of the cup shielded from outside air," explained Beguin. "It should be hermetic. And that is quite difficult to achieve, believe me. But we have achieved a perfect seal at all times."

Rumbles Get Through

Beguin continued that it is impossible to block out entirely loud noises of low frequency, such as the rumble of a jet engine. It is possible, however, to block off by means of the protectors sound waves of high frequency such as the high pitch of a violin.

Thus when working near a roaring jet engine, mechanics can concentrate without the nausea, headache of fatigue that deafening rumbles often cause. Furthermore, the men can talk effortlessly as long as they remain within normal talking distance.

If the ear protectors were worn in Symphony Hall during a performance, the percussions and bassoons instruments of low frequency — would be audible but soft, whereas the oboe, clarinet or violin — instruments of high frequency—would be in effect silenced.

When acoustical engineers speak of noises they compute the intensity and pitch of sound waves in terms of decibels and cycles. The intensity of the normal speaking voice is about 75 decibels, and any sound above 95 decibels is above the safety margin for man's hearing.

The most intense sound yet recorded, such as the sound waves generated by a Mercury rocket, has been reckoned at 180 decibels.

Range Varies

The pitch of sound is computed in cycles. Normal hearing range of the average person under 21 years of age ranges from 20 cycles to about 17,000 cycles, allowing for individual variations.

In rare cases a person's hearing capability can extend to 20,000 cycles.

Some sounds, Beguin said, have a high pitch and low intensity. Noises of high pitch can be blocked from the human ear because these sound waves penetrate the brain only through the ear.

But sounds with low frequency enter through a person's bones as well as through his ears, or what Beguin refers to as body vibration. For example, he said, a low note played on an organ can still be heard even if a person closes his ears with his fingers. The sound wave of that note is so intense that it actually strikes the chest and head and is relayed to the brain by the bone structure.

Beguin illustrated this bone-relay through means of a bone vibrator, a special device installed in a sound proof room constructed for acoustical experiments. The room is constructed of steel, weighs 17 tons and rests on resilient springs to prevent any vibrations from outside noises or movements.

Circulation Heard

The room is so silent that after 10 minutes a man can hear his heart beating and his blood swooshing through his veins. Fiberglas paneling along the walls and ceilings distribute sound evenly throughout the room.

Here Beguin has conducted acoustical experiments on persons with normal hearing to test the performance of his ear protectors. Other tests are conducted on artificial skulls so that sounds with a known intensity and pitch can be tested against an ear protector on the skull. Special microphones inside the ears indicate how much sound, if any, actually got through.

This means of testing renders an objective criterion without the subjective variations inevitable in a human subject.

It is expected that these ear protectors soon will include microphones and transistors. This will enable members of a crew to communicate short distances without interference from loud noises nearby.

The attention that AO has given to acoustics since 1960 is indicated in a relatively new motto to reflect the modern age. Since 1833 the optical firm has borne the motto, "Better Vision for Better Living." Though this caption still decorates the spacious green lawns of the company's headquarters here, it has been supplemented by another:

"Products That Extend and Protect Man's Physical Senses."

SOUND PROOF ROOM for acoustical experiments at American Optical Co. in Southbridge features fiberglass paneling along the walls and ceiling to distribute evenly test sounds fed into the room through speakers. Here Fred P. Beguin, left, tests the ear protectors on a man against loud volumes. Arnold J. Simpson, AO technician (inset), models the ear protectors.