INVENTION

# New Aid For Deaf Transmits Sound Through Bones or Teeth

## Device, Serving Purpose Similar to Loud Speaker in Radio Set, Permits Afflicted Persons to Enjoy Music

A NEW device that brings radio and phonograph music to the deaf, not by way of the outer and middle ear passages but through their teeth or the bones of their heads, was demonstrated before the National Academy of Sciences, by Dr. Frederick Bedell, physicist of Cornell University.

Dr. Bedell describes his apparatus as a "deaf speaker," because it serves a purpose similar to the loud speaker in a radio set. The deaf speaker, however, does not broadcast sound, but carries it directly to the person who holds the receiving part of the apparatus between his teeth or pressed against cheek bone or forehead. To other persons in the same room, the apparatus is silent, which Dr. Bedell regards as one of the notable advantages of the device.

### Defective Middle Ear

The theory upon which the physicist worked out his new speaker was that the majority of persons with defective hearing have a defective middle ear. His aim was to bridge that middle ear and bring the sound waves to the inner ear by some other channel.

By means of bone conduction this can be done. But it is not enough, Dr. Bedell found in his experiments, to transmit vibrations of the same frequency as the actual sound waves themselves to the inner ear of the listener. In order for him to hear through the bones, the vibrations must be adjusted to a suitable loudness, and force, and frequency. This adjustment is substantially what takes place in the normal middle ear. Dr. Bedell's deaf speaker achieves the adjustment by stepping up the force of the sound waves and making the amplitude or size of the waves smaller.

Since some persons are deaf to high tones and others fail to hear lower tones, the deaf speaker is provided with a means of fitting the type of tone to the listener's particular problem.

Dr. Bedell displayed two kinds of receiving instruments, or applicators, which he has developed. One kind is held between the teeth, and looks like a long tube. The tip, made of thin wood, is removable, so that more than one person may use the same machine without using the same mouthpiece. The other receiver, a face applicator, is a flat disk to be held against cheek bone or forehead.

False teeth, the physicist said, are no hindrance to hearing with the mouth applicator. The disk type of applicator makes it possible for the listener, by means of a microphone, to hear his own voice. This is an advantage to the hard of hearing who rarely are able to know how their own voices sound.

The apparatus can be used with a microphone for teaching the deaf, Dr. Bedell reported to the Academy meeting. The box containing the apparatus is portable, but is not small enough to be carried on the person for general use.

"Nearly 15,000,000 people because of defects in hearing are completely debarred or partly debarred from enjoying benefits of radio programs and phonograph music," the physicist stated. "The need therefore is evident for a deaf speaker which will give audition to the deaf similar to the audition given by a loud speaker to those having normal hearing."

That bone conduction can be used to carry sound waves to the inner ear has been recognized, but has not been widely applied in devising aids for the deaf.

It has long been known that, if a piece of cardboard is held before the mouth and one end of the board is caught under the upper teeth, curving the board, it is possible to hear conversation with the ears stopped. Greater volume of sound is necessary for bone conduction than for hearing through air passages of the ear.

Persons using a telephone often use bone conduction without thinking of it when they press the receiver tightly against the ear. The bone in front of the ear thus aids in catching the sound.

It is possible to hear music on a phonograph record by holding a long needle between the teeth and placing the needle in the grooves of the revolving record. This shows the principle of bone conduction although it is not a very practical working device.

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**HEARING IN SILENCE**

***Dr. Frederick Bedell, physicist of Cornell University, using the face applicator which he demonstrated before the National Academy of Sciences.***

PHYSIOLOGY

## Racial Factor Involved In Rate of Metabolism

THE RATE at which certain vital energy interchanges go on in the human body varies with different races, it appears from the report of Dr. Francis G. Benedict of the Carnegie Institution of Washington's Nutrition Laboratory

at Boston, to the National Academy of Sciences.

Dr. Benedict studied measurements of the heat production which accompanies these changes in Mayas in Yucatan, in pure-blooded Aboriginals of the Kokata Tribe in South Australia, in Tamils and Malayalis in Madras, and in a group of American-born, pure-blooded Chinese girls of Boston. He found wide differences in the heat production of these various groups which could not be explained entirely on account of difference in size, dietetic habits, climatic conditions or sex. He concluded that the difference was due to the racial factor.

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ARCHAEOLOGY

# Jewels Suggest Aztec King Lay in Monte Alban Tomb

## Rings and Ornaments Found There Said to Bear the Hieroglyphics of "Fallen Eagle," Great Indian Hero

IN DISCOVERING the famous treasure tomb of Monte Alban Mexican archaeologists may have come upon the burial of "the fallen eagle," last of the Aztec kings. This is the suggestion brought to the attention of archaeologists by Mrs. Zelia Nuttall, well known American archaeologist of Mexico City.

Mrs. Nuttall's theory that one of the skeletons in the Monte Alban tomb may be that of Cuauhtemoc, last Aztec king, is based upon study of jewelry and other objects in the tomb. Certain of the rings and ornaments bear the hieroglyphs of the name of this great Indian hero, whose name meant "fallen eagle." Circumstances of Cuauhtemoc's death also dove-tail with evidence in the tomb, Mrs. Nuttall considers.

Cuauhtemoc became king of Mexico in the last stormy months of the Spanish Conquest. He refused to reveal the whereabouts of his country's treasure to the conqueror Cortes, in spite of the torture of having his feet burned. For this, the Aztec king has gone down in history and every Mexican school child knows his heroic story. He is commemorated in Mexico by many monuments, and streets are named after him.

Cuauhtemoc's last journey began when Cortes carried him along, as a prisoner, on an expedition to Honduras, in October, 1524. Cortes made this twenty-month march from Mexico City to Honduras in order to punish some subordinate who rebelled. He took the Aztec king, as he wrote the king of Spain, "because he was a dangerous man; and with him I took along also all the other lords I thought might start a revolution in that country."

The road the expedition took to the south was through the province of Oaxaca. The province had been subdued in 1521, and the sacred burial places of Monte Alban and Mitla had already been sacked by Spanish soldiers in search of treasure.

When the expedition reached Acalan, Guatemala, a chief from the Mexican state of Michoacan denounced the Aztec chieftains to the Spaniards. Cortes had them tried for conspiracy and hanged Cuauhtemoc and one other, but freed the rest.

History does not say what became of the body of Cuauhtemoc, but Mrs. Nuttall believes it must have been treated with all the honors accorded to the line of Aztec Montezumas, or chieftains, who were almost sacred personages to the Mexican Indians. The remains would have been disposed of in a safe and secret place worthy of nobility. No place more suitable could have been found, Mrs. Nuttall says, than Monte Alban, sacred city in Oaxaca's mountains on the road back to Mexico City from Honduras. Monte Alban must have seemed safe then, for it had already been sacked, and the Spaniards would probably not return a second time.

Mrs. Nuttall enumerates arguments that might tend to identify the skeletons in Monte Alban's treasure tomb as those of Cuauhtemoc and other Indians who died on the Cortes expedition.

No weapons of any kind were found with the bones, and that could mean that the dead were captive men. No idols were present, and this might be consistent for companions of Cortes, ostensibly converted.

There were fine red shell beads, unknown in Mexico, but common in trade among the Indians of Acalan, the place in which Cuauhtemoc died. Cortes states in a letter to his king that the Indians of that land presented them with gifts of gold and small red shell beads they used as money.

Two skeletons of the Monte Alban tomb stand out for the richness of their jewels, Mrs. Nuttall pointed out, and these might be the two Aztec chiefs that Cortes hanged.

Mrs. Nuttall's theory suggests an interesting and important line of research said Enrique Juan Palacios, Mexican archaeologist, who offers, however, an alternative explanation of the fallen eagle symbols. The eagle was the sacred animal of the sun among ancient Mexicans, Sr. Palacios says, and in a golden pendant where the eagle figure occurs, there are also four rays of the sun. The eagle descending could represent the overhead sun of midday, and Indians of Oaxaca actually did represent the midday sun as a diving being.

The only date on jewels of the Monte Alban tomb is "eleven House twelve Wind." Just as "Tuesday, April 19" can recur in our calendar at calculated intervals, so "eleven House twelve Wind" can recur in the Mixtec calendar every 52 years. From other evidence, Alfonso Caso, discoverer of the Monte Alban tomb, believes the burial was made at a time not remote from that of the Spanish Conquest. The nearest Mixtec dates, "eleven House, twelve Wind," before and after the Spanish Conquest, are 1477 and 1529. The first is too early to represent Cuauhtemoc's death, and the second too late, for his death occurred in 1525.

### Buried Twice

It is pointed out by others, however, that Indians of Oaxaca and elsewhere, practised "secondary" burials. They buried their dead, and later, when the flesh was decomposed, the bones were exhumed and reburied. They were sometimes covered with gold leaf, and skulls were inlaid with turquoise and other precious substances. Tombs have been found in Mitla, Oaxaca, where entire skeletons were thus gilded, and in another burial found in Guerrero, in March, 1932, skulls were covered with gold foil. A cranium in the Monte Alban grave was also encrusted with turquoise.

The bones of Cuauhtemoc, buried perhaps in foreign soil in 1525, could have been brought back later by his people to the sacred city of the dead, Monte Alban, which had the fame of being an entrance to the other world.

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