PHYSIOLOGY

Auditory Nerve Cannot Carry Highest Audible Frequencies

Scientists Detect Frequencies Up to 2800 Cycles in Nerve But Cannot Explain How Higher Pitches Reach Brain

HOW CAN you tell the highest note of the violin from the deepest boom of the bass tuba? The puzzle of how to account for the ability of the human auditory mechanism to perceive various pitches was the subject of researches reported to the meeting of the National Academy of Sciences in Cambridge by Drs. H. Davis, A. Forbes, and A. J. Derbyshire, all of Harvard Medical School.

Although their findings have thrown considerable light on the problem they have also served to complicate it, because they serve to demonstrate that one of the familiar theories of hearing may apply to the hearing of low tones, but not of the highest pitches of stringed instruments and shrill squeaks.

This theory of hearing assumes that the high pitch is perceived as different from the low pitch because the frequency of the sound waves is transmitted to the higher nervous centers as a corresponding frequency of the nerve impulses in the auditory nerve. Other nerves in the body are not able to respond to impulses following each other as rapidly as the succeeding waves of a high pitched sound. But this theory has also assumed that the auditory nerve might have a much briefer recovery period than other nerves.

"Listen in" on Cat Nerves

The Harvard researchers picked up the action currents from the auditory nerves of an anesthetized cat by a sort of "listening in" arrangement and measured them on a cathode ray oscillograph. They found that when the sound reaching the ear was of a frequency of 700 or lower—that is, below the upper limit of the cello or alto singing voice—the frequency of the action currents of the auditory nerve was exactly the same.

Between 700 and 900, a sharp change occurs in the amplitude of the waves picked up. It drops to approximately half the size of those produced by equally loud sounds of lower frequencies. This is interpreted by the investigators as meaning that the nerve fibers have reached their speed limit and now respond to only one of each two successive waves. Since only half the fibers respond to any one wave, the size of the response is only half as great as when all were working.

At a frequency of 1700—somewhere among the high notes of the flute and violin and above the limit of the clarinet—another drop occurs indicating a breaking up of the nerve fibers into three groups each responding to every third wave.

Not Unique

At a frequency of 2800, however, the responses become completely irregular.

"The auditory nerve is in no way unique in respect to its ability to transmit high frequencies of impulses," the investigators concluded. "Furthermore, even by virtue of rotation of activity, the frequency of stimulation is not represented centrally above 2800 per second. Therefore, pitch discrimination for high tones must depend upon some selective activity in the cochlea and not involve the frequency of nerve impulses. For tones of low pitch, however, a frequency theory is still possible."

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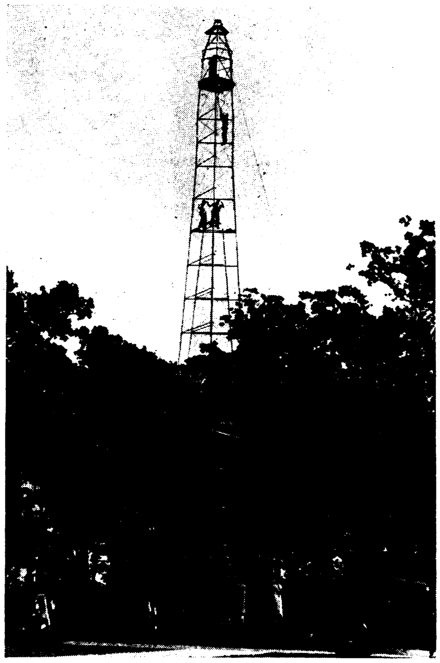

FULL HEIGHT

ENGINEERING

Steel Towers Go Up and Down To Speed Survey of Country

See Front Cover

WORK ON control surveys of the United States is being rapidly pushed forward under funds recently provided by the Public Works Administration to The U. S. Coast and Geodetic Survey. Although the immediate purpose is to provide employment to a great number of men, the present program fits into the plan to cover the country with a close network of triangulation stations so that no point will be more than 12½ miles from a station. Boundaries of private properties and political units may then be much more certain and much costly litigation may be avoided.

Press representatives in Washington were recently allowed a peep behind the scenes when they were invited to witness the erection of one of the triangulation towers on the campus of the University of Maryland. The tower, which is shown, in the process of erection, on the cover of this issue of SCIENCE NEWS LETTER, although approximately 100 feet high, was put up in only about three hours. It is a double structure, the outer portion, supporting the observer's platform and the light, being without contact with the inner tower on which the surveying instrument is placed, so as to prevent any jarring of the instrument.

The sections of the tower, which was designed in 1927 by Jasper S. Bilby of the U. S. Coast and Geodetic Survey,