

ENGINEERING

# "Auditory Perspective" Given To Electrical Transmission

## New Method Will Bring Orchestra To National Academy With Greater Range and Control of Tone and Volume

**T**HREE LOUD SPEAKERS on a stage empty of human beings but bathed in colorful light, three telephone lines running to three microphones in a sound-proof room containing the Philadelphia Symphony Orchestra, Leopold Stokowski whirling electrical control knobs instead of wielding a baton, telephone engineers alert in operating the electrical circuits.

These were the ingredients of the most advanced development of musical reproduction that will be introduced to the public in a Philadelphia-Washington concert for the National Academy of Sciences on April 27.

In a private preview for scientists and music critics held at the Academy of Music in Philadelphia, the American Telephone and Telegraph Company engineers demonstrated the results of two years of scientific research conducted with the collaboration of Director Stokowski.

### Whispers and Thunder

Wagnerian music was played with whispering pianissimi and thunderous crescendos hitherto unheard by human ears. Stokowski by the turn of a control knob could subdue his orchestra, isolated in another part of the theater, to a mere trickle of sound or he could build up their music to the sound of two thousand musicians at a peak of output.

Brünhilde, sung by Miss Agnes Davis, became an electrical super-vocalist, rising above the orchestral accompaniment of the *Götterdämmerung*. Wagner's music was rendered as probably he never dared to dream it might be played.

This merging of music and telephone science has introduced jointly three factors in the electrical reproduction of orchestral music: 1. Auditory perspective. 2. Tone and overtone control. 3. Volume control.

Three loud speakers at left, right and center of the empty stage, each connected with a similarly placed microphone on the remote stage of the actual performers, give perspective to the music

and sounds. Musicians could tell just where the violins or horns were placed. In one demonstration, stage hands moved across the distant stage and the audience of the empty stage "followed" them about the empty stage by using their ears. Engineers had previously felt that this illusion of auditory perspective might be obtained only with many loudspeakers on the empty stage, but three were found to give perfect results when the electrical transmission had high quality.

### Nine Octaves

A wide range of nine musical octaves, from three below middle C to nearly six above, was utilized for the first time in electrical transmission of music. This corresponds to all frequencies from about 35 cycles per second to about 16,000 cycles per second. Radio by federal regulation is limited to a band of 5,000 cycles per second. When experimentally the high and low frequencies are chopped off by electrical filters the damage to the tone and overtone qualities was readily apparent. Each of the three telephone wires carried the full range of frequencies, and the frequency channels utilized therefore roughly totaled nine times those of the most perfect radio transmission.

In loudness range, the orchestra or other sound being transmitted can be varied from an output equivalent to a millionth of a watt to a sustained hun-

dred watts and even a kilowatt at momentary peaks without distortion. The sound in the demonstration was raised from the rustle of leaves to beyond that of a roaring airplane engine.

Practical applications are foreseen by the telephone engineers and Director Stokowski. A symphony orchestra in one place may render its concerts with perfect tonal quality and with improved volume in a hundred or a thousand different halls in distant cities. Music may be spread from high towers so that 100,000 may enjoy it in large parks. The musician and composer can add electrical amplification and control to his material out of which beautiful sound compositions are wrought.

*Science News Letter, April 22, 1933*

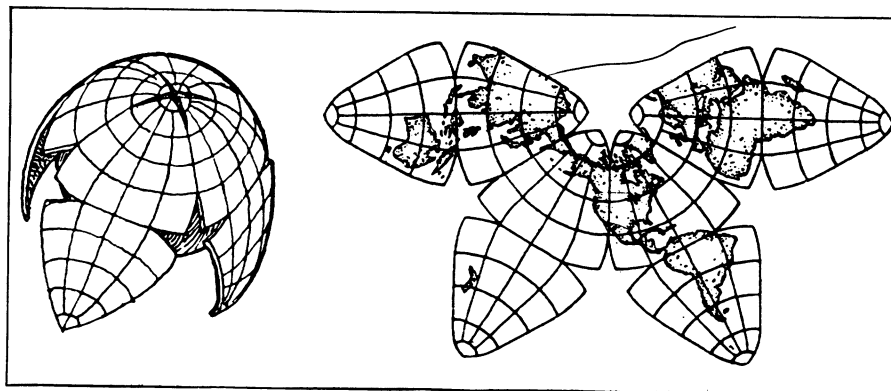
GEOGRAPHY

## New Map Suggested As Accurate World Picture

**C**ANADA'S size is no longer misrepresented to the world and Russia's vast domains are reduced to their proper proportions on a new map proposed by B. J. S. Cahill, an architect of Oakland, Calif.

Slice an orange into quarters and mash the peeling flat under a glass allowing the quarters to pop open a bit along the equator. That is the way the new map is formed and hence, from its peculiar shape, the name butterfly map. The idea was proposed by Mr. Cahill 23 years ago, but he has recently expanded the original suggestion and worked out three forms of the butterfly map in detail.

One form, pictured below, projects the area of the earth accurately so that the size of a far north country may be fairly compared with that of one nearer the equator. Thus Canada is properly represented smaller than the United States instead of more than (*Turn Page*)



SLICING UP THE EARTH