line, together with the music band. This transmitted 20 kilocycle control current is used at the receiving end by a frequency doubling device to supply the accurately phased carrier needed for demodulation.

NOISE

As has been referred to earlier, noise entering the transmission system is a limiting factor in determining the extent to which low level sounds can be transmitted and reproduced. Noise can reach a cable circuit in either of two ways. (a) It may enter the cable through the sheath from radio or power fields through which the cable passes, or (b) it may enter the cable at the ends or intermediate points along other circuits in the cable which are operating in a lower frequency range.

So far as (a) is concerned at the frequencies employed and for the transmission levels used, this particular Philadelphia-Washington cable is quiet and was found to require no special arrangements.

With respect to (b) the repeater layout is such that it was not necessary to take special steps, except at Baltimore. Here the volume levels from the north were sufficiently low so that high frequency noises produced in the office as a by-product chiefly of telegraph and switching operations passed into the cable over working circuits and cross-talked into the pairs used for the special broad band transmission. To prevent this the cable north was "isolated" from the office by putting choke coils in every pair in the cable. These choke coils are non-inductive to ordinary telephone or telegraph currents. They are inductive, however, to currents flowing over any of the conductor systems to ground.

LOCAL CIRCUITS

The carrier apparatus is located in the toll terminal offices at Philadelphia and Washington. Small gauge equalized underground cable circuits are used between the Academy of Music and the telephone office in Philadelphia and similarly at Washington between the telephone office and Constitution Hall.

AUXILIARY FEATURES

As has been previously mentioned, spare circuits are available in the cable to substitute in the event of any breakdown of the regularly assigned carrier pairs. Secondary spares of slightly lower frequency range capacity have also been provided in another cable to be available in the remote possibility of something happening to completely disrupt the cable carrying the regular circuits.

SUMMARY

In conclusion, all that need be pointed out is that the system just described is one designed for the reproduction in auditory perspective of symphonic or other music to an audience. Because of its multichannel character and its wide range of frequency and energy capacity, it is not readily adaptable for use in small rooms. While theoretically susceptible of employing any set of transmission channels capable of handling the desired frequency and volume range, it is at least in the present state of the art restricted essentially to wire transmission systems. This restriction arises from three main sources: (1) The ability to free the system against extraneous electrical or noise disturbances which at times so frequently mar radio transmission. (2) The uniformity with which transmission characteristics can be maintained and the relative ease with which the effects of attenuation can be overcome by intermediate repeaters. (3) The fact that under existing statutory regulation of radio it is impossible to secure clear channels of a frequency band requisite for the complete transmission of all the fundamental and overtone frequencies produced throughout the full range of musical instruments and the human voice.

Whether for local or distance use, the easily controlled and very tremendous volume ranges which the apparatus is capable of handling without distortion have placed in the hands of the musical director an implement for tonal effects not hitherto attainable. What the future use of the system in all its parts is likely to be will depend in large measure not only on the extent to which it is desirable to produce perfect music in auditory perspective at a distance remote from the source but likewise on the extent to which musical composers and directors find it effective in producing artistic effects beyond the capacity of the largest orchestras or choruses.

OBITUARY

ARTHUR HOLLICK

1857–1933

DR. (CHARLES) ARTHUR HOLLICK was born in 1857, the son of Frederick and Eleanor Eliza (Bailey) Hollick. He graduated from the Columbia School of Mines, 1879, and from the George Washington University in 1897 with the doctor's degree. He married Adeline Augusta Talkington in 1881. Although scientifically he was a paleobotanist of distinction, he filled many public offices, since he was a man of wide human interests. He was a member of the City of New York Board of Health from 1883 to 1893, a

member of the New York State Board of Education from 1907 to 1910, and of many local public services during the whole course of his life.

His academic positions were as follows: Tutor and fellow of Columbia University in geology, 1890–1900; curator of fossil botany, Columbia University, 1900–13; honorary curator, 1914–21; paleobotanist, New York Botanical Garden, 1921 to the time of his death; geologist to the United States Geological Survey; director of the Board of Education of New York City, 1907–10. He belonged to a large number of scientific organizations, including the New York Academy of Sciences, the Torrey Botanical Club, the Staten Island Institute of Arts and Sciences, the Geological Society of America, the Paleobotanical Society of America, the Botanical Society of America, etc.

His main scientific activities were in connection with fossil plants, and his first contribution was the editing of "The Later Extinct Floras of North America," left in form of notes by J. S. Newberry. He published during his active years a large number of papers on paleobotany, covering the Mesozoic and later floras. His most notable contributions were on the Cretaceous floras of New England, which were summarized as an important Memoir of the United States Geological Survey. Another extremely important and indeed classic contribution was on "The Fossil Flora of Alaska," which appeared a short time before his death. Not only was he the author of innumerable papers on fossil plants, but he acted officially in the paleobotanical publications of Puerto Rico, Louisiana, Maryland, New Jersey, New York State Museum and the Dominion of Canada. He was likewise a contributor to several general works, including the articles on paleobotany and fossil plants in the new International Cyclopaedia and also the Encyclopaedia Americana.

Hollick was a singularly lovable man and it was a great pleasure to make visits to the field in his company. The present writer recalls the happy days spent in this way on Staten Island, Long Island, Martha's Vineyard, the coast of New Jersey, etc. He was an indefatigable collector and was physically almost tireless. He would walk for hours through mud and rain and other discomforts in search of new discoveries in his favorite field. A not infrequent experience in paleobotanical excursions is dirt and discomfort (including parasites). These he endured most philosophically and the tedium which invariably arose at times was relieved from the rich store of his experiences. His last excursion was in Cuba, where he rode many hundreds of miles on horseback in the company of a good Spanish officer of the Church, who was at the same time a geologist. He returned from this last excursion apparently in the best of health, but unfortunately soon developed a malignant malady which was unsuccessfully operated on, and he passed away with traumatic pneumonia.

Dr. Hollick has left an enduring mark on American paleobotany, and particularly his works on the fossil floras of New England and Alaska will long stand as classic contributions to the subject. It has been for years a deplorable fact that too little interest has been devoted to the important subject of fossil plants in the United States. The older generation was passing and there were almost no promising successors. Fortunately at the present time this tendency has been corrected, and now a considerable number of young men of ability are taking up the study of extinct plants. In spite of the prevailing mechanistic tendencies of the hour, it is indubitable that paleontology occupies the same position on the intellectual side of biology that the ancient classics do in literature. There seems to be no doubt that the depth and background furnished by the study of extinct forms is an invaluable preparation for biological studies of any kind.

E. C. JEFFREY

MEMORIALS

A FRIEND of the late Olive M. Lammert, formerly professor of chemistry at Vassar College, has given $4,000 to establish the Olive M. Lammert fund to further the work in physical chemistry, and $1,000 for additional equipment in the precision laboratory, in which this work is carried on. The rooms in the Sanders Laboratory set aside for this field of study will be designated the Olive M. Lammert Laboratories.

AT a memorial meeting for the late Professor William Henry Holmes, held in the National Museum on April 22, the following resolution was passed:

WHEREAS: Notice of the passing of our colleague and friend, Professor William Henry Holmes, which occurred at Royal Oak, Michigan, on April 20, 1933, has been received with deep sorrow by members of the Smithsonian Institution and his other associates and friends; be it

Resolved: That we, assembled here to do honor to him, offer our tributes to this eminent man of science in whom the various phases of both art and science were fused to a degree seldom given in one man. Art, science and technic were the agencies he applied to the elucidation of his favorite science, anthropology. His passion for pure art is seen in his paintings which are poetical transcriptions of nature, not only portraying nature but revealing his inmost soul;

That his scientific writings and explorations form permanent contributions to the sum of human knowledge;

That we here record our sense of loss at the passing of Professor Holmes and extend to his family our sympathy in their sorrow.

ACCORDING to the London *Times* the hundredth anniversary of the death of Richard Trevithick, the