variation) from many types of tree. There is a suggestion in this constancy that the tree produces some nitrogenous compound to an optimum concentration, either as an auxiliary to the synthesis of caoutchouc or as a side product of that synthesis. Tristram's results thus throw an interesting light on such a suggestion, indicating the place of these reactions as in the Hevea leaves, a natural site for photosynthetic transformations. Further results in this field will be awaited with impatience.

THE 200-IN. TELESCOPE

THE twelfth Thomas Young Oration was delivered before a meeting of the Physical Society by Dr. H. Spencer Jones, Astronomer Royal, on May 30. He described some features of the 200-in. telescope now being constructed for the California Institute of Technology.

This telescope was made possible by a grant of six million dollars from the Rockefeller General Education Board. The design and construction of a telescope of double the aperture of the largest telescope previously built required careful consideration of a large number of problems. The primary problem was the construction of a 200-in. mirror. If made, in accordance with previous practice, of a solid block of plate glass, annealing for nine years would have been required. Mirrors of stainless steel or of metal coated with glass of the same coefficient of expansion were considered but were regarded as too experimental; fused quartz with a surface coating of clear quartz was tried but abandoned, not because the difficulties were insuperable but because the cost would have been too great. A special pyrex glass of high silica content, with a coefficient of expansion only three times that of quartz, was finally decided upon. The disk was cast, by a special technique evolved after much experimental work by the Corning Glass Company, with a ribbed honeycomb structure at the back to reduce the weight without sacrifice of rigidity. Annealing for ten months proved to be adequate for this special glass. The disk weighs 14½ tons and its optical figuring is well advanced.

The mounting embodies many new features. It is of a modified yoke type, the upper bearing being in the form of a giant horseshoe, 46 ft. in diameter, within the throat of which the telescope can lie for observations at the north pole of the sky. Only one machine in the world was large enough to machine this bearing. The yoke arms are hollow cylinders, 10 ft. in diameter, joined by a bent box girder 46 ft. long, which carries the hemispherical thrust bearing, 7 ft. in diameter. An oil pad flotation system enables the 450 tons of the moving parts to be turned with a torque of only 50 lb.-ft. The primary focus is at $f/3 \cdot 3$ and the observer makes his observations within a 6-ft. diameter cylinder, supported from the upper cage of the tube. The Cassegrain focus is at $f/16$ and observations can be made either at a focus just below the central hole of the 200-in. mirror, where there is a platform for the observer, or, by the interposition of a diagonal flat mirror, within either of the hollow yoke arms. The Coude focus is at $f/30$, and observations with high dispersion spectrographs can be made within a constant-temperature room just south of the telescope. At the primary focus, coma would be serious at a small angular distance from the axis; two special correcting lenses of zero power have been designed to eliminate coma. For observations of faint objects, with low-dispersion spectrographs, two special short-focus camera objectives of great relative aperture have been constructed; one of these, with relative aperture of $f/0 \cdot 35$, on the principle of the oil-immersion microscope objective, is of British design and construction. The ingenious image-slicer, designed by Dr. Bowen, will give a greatly increased efficiency in all spectrographic observations.

All auxiliary mirrors are permanently carried on the mounting and can be operated by remote control. The telescope drive is of an elaborate nature; the effects of changing refraction, of differential flexure and of errors in the gears are automatically allowed for by a system of 'computers'. A quartz-crystal oscillator provides the fundamental control of the rate of drive. A complicated system of Selsyn or interlock motors enables the telescope to be set rapidly to any predetermined position, the position of the dome and of the windscreen being automatically adjusted.

WIRED RADIO BROADCASTING

WIRED broadcasting has already appeared in service in Europe and other parts of the world. An article written by N. Shinohara and Y. Hirano, of the Ministry of Communications, Tokyo, in the January issue of the *Nippon Electrical Communication Journal*, a summary form in English of the journal of the Institute of Electrical Communication Engineers of Japan, discusses the subject, stress being laid on experiments and the basis of network design.

In one method, a wireless radio receiving and wired radio transmitting station is located at a position near a crowded area of listeners or in a suburban district, where there is little electrical disturbance. The programme received at this station is converted to audio-frequency and sent over special lines to the listeners. This method is known in Japan as an ordinary form of common broadcast reception. The programme is distributed at a fairly high level of volume, so that it is only necessary for the listener to instal a loudspeaker. The resulting low cost of the receiving apparatus is an advantage. The disadvantages, however, accompanying radio-broadcasting cannot be avoided, because this method has an intermediate wireless system. Also a large expenditure of money and materials is needed for the installation of special lines to listeners.

A second method makes use of telephone lines, to which the broadcast programme is supplied at audio-frequency. While this method greatly