7. A Study of the Compressions of High Molecular Weight Hydrocarbons. W. G. CUTLER, W. WEBB, AND R. W. SCHIESSLER, *The Pennsylvania State University*.—The study of the behavior of liquids under pressure dates back to the work of the English scientist, John Canton, in the middle of the eighteenth century. The most significant advances in high-pressure work have been made by P. W. Bridgman in the current century and his techniques have widely increased the pressure and temperature ranges of high-pressure research. An ASME research project at Harvard University and American Petroleum Institute Research Project 42 at Pennsylvania State University have done considerable work in studying the behavior of petroleum fluids and very pure liquid hydrocarbons at high pressures. This paper deals, in particular, with the volume behavior of these liquids as a function of temperature and pressure. The pressure range of these measurements was from atmospheric pressure to as high as 150 000 pounds per square inch. The high purity of the hydrocarbons used has enabled observations of the structural dependence of the compressibility to be made. The Tait equation

$$v_0 - v = C \log(1 + P/B)$$

provided a good empirical fit for the isotherms. In the foregoing equation C and B are constants, v is the specific volume at pressure P, and v_0 is the specific volume at atmospheric pressure. The Hudleston relation

$$\log[v^{2/3} P/(v_0^{1/3} - v^{1/3})] = a - b(v_0^{1/3} - v^{1/3}),$$

where a and b are constants and other symbols have the same meaning as above, has also been examined. Isobars and isochores have been drawn and studied over the full range of temperature and pressure.

8. The Effects of Pressure and Temperature on the Viscosity of Hydrocarbon Liquids. D. A. LOWITZ, W. WEBB, AND R. W. SCHIESSLER, *The Pennsylvania State University*.—Progress in understanding the behavior of the viscosity of liquids under extreme pressure has been slow because of the difficult experimental techniques involved. This knowledge has been made more accessible since the work of P. W. Bridgman opened the door to the studies by his development of successful experimental methods. Recent work done at Harvard University by an A.S.M.E. project contributed considerable information on the viscosity–temperature–pressure characteristics of lubricating liquids. For several years the American Petroleum Institute Research Project 42 at the Pennsylvania State University has been studying the viscosity of very pure high molecular weight hydrocarbons as a function of pressure and temperature. This paper discusses the progress made in these studies.

9. Films and Filmloops as Supplements to Lecture Demonstrations. JOHN J. HEILEMANN, *Ursinus College*.—The Visual Aids Committee of the AAPT has been considering the production of filmloops and short films of apparatus which is too large to be brought into the classroom or which is usually on the lecture table but is too small to be seen by a class. There is also no doubt much rare and unusual apparatus, moving pictures of which would be valuable in teaching. Examples are shown and the cost and manner of distribution discussed.

10. Quantitative Measurements with a Modified Schilling Sound Apparatus. ROSALIE C. HOYT, *Bryn Mawr College*.—Commercial electrostatic tweeters now available provide excellent sources of high-frequency sound in the range from 1000 cps to 20 000 cps. In particular the Philco No. 36-1656 tweeter serves as an excellent and cheap line source. It radiates uniformly over 180° and is 16 cm in length. While crystal microphones cut off above 15 000 cps, a quite satisfactory detector covering the 1000-cps to 20 000-cps range can be obtained by operating a second Philco tweeter in reverse. The Galton whistle in the rear of a Schilling sound diffraction box has been replaced by a Philco tweeter driven by an audio-frequency oscillator. The output of the second, or detector, tweeter, is amplified and presented on a CRO screen. The equipment can be used by students to perform many diffraction and interference experiments with excellent quantitative results. For example Young's double-slit experiment can be used to determine wavelengths to a precision of better than 1%.

11. Phase Shifts and the Doppler Effect. WALTER C. MICHELS, *Bryn Mawr College*.—A simple derivation of the Doppler shift, which emphasizes the physics of the effect and minimizes the formal treatment, is obtained if one considers the phase shift of $\Delta n = -\Delta x/\lambda$ (cycles) which occurs whenever the separation of the observer and the source is increased by Δx. This phase shift may be demonstrated with a CRO. The Doppler shift of frequency is obtained as $\Delta f = \Delta n/\Delta t$, where Δt is the time taken for the phase shift to occur. If the observer is moving away from the source with a velocity component v with respect to the medium in which the wave is propagated, $\Delta t = \Delta x/v$; if the source is moving, correction must be made for the additional time taken for the wave to travel a distance Δx, so $\Delta t = \Delta x/V + \Delta x/v$, V being the speed of propagation. The relativistic Doppler effect follows merely by application of the Einstein time dilatation to the source as seen by the observer.

12. X-Ray Spectra and the Simple Bohr Theory. L. MULDAWER, *Temple University*.—Some common errors in the application of Bohr theory to x-ray spectra are discussed. In particular, the use of single-electron energy changes in place of atomic-energy changes is especially bad. A simple way of avoiding either over-simplification or over-complexity is to sum all electronic energies before and after the electron transition using nuclear charge reduced by inner electric charge in the before and after cases. Wavelengths calculated by this method are in good agreement with actual values. Use of this technique gives the student a feeling for the fact that *atomic* changes are taking place.

13. Industry's Stake in the Teaching of Engineering. ALTON P. WANGSGARD, *Hughes Aircraft Company* (intro-