nificant trend in educational services is the steady extension of graduate study programs to off-campus locations. Also, in contrast with some professional schools, enrollment in graduate schools has always been open to all qualified students. Dr. Longenecker emphasized the relatively scant attention currently being devoted to the nontechnical fields in most graduate schools. For example, there is little study of Near and Middle East language and area subjects. A dangerous trend in graduate school enrollment is the disturbingly large number of college graduates who seek to do graduate work although they possess only the barest minimum of requirements for graduation at the bachelor's level. Dean Longenecker described the special examinations used at the University of Pittsburgh to test entering graduate students and thus to advise them more effectively concerning their aptitudes and potentialities. The papers presented at this session were summarized by Marsh W. White, of the Pennsylvania State College.

The final session of the conference, presided over by Dael Wolfle, was on "Selection Techniques: Psychological Background". Henry Chauncey, president of the Educational Testing Service, for the first time released data concerning the results of the Selective Service College Qualification Test. These results were highly significant and, in some instances, startling. Important differences in test performance were noted in the various geographical regions; the Middle Atlantic states ranked highest and the Southern states the lowest. By major fields of study the engineering and physical sciences ranked highest, followed in turn by the biological sciences, social sciences, humanities, arts, commerce, agriculture, and education. One finding of particular importance is the tremendous variability noticed among various colleges and universities, with some institutions having nearly 100% of their students receiving a passing score and some with as low as 35% passing. Technical schools ranked consistently higher than the arts colleges. The findings available to date amply confirm the original expectation that these tests, along with rank in class, would effectively serve the purpose of giving capable students an opportunity to qualify for deferment. A paper prepared by C. J. Lapp discussed "The Effectiveness of a Selection Program for Scientists". Dr. Lapp emphasized the benefits which fellowships yield to society as a whole, as well as to the individual fellow. There have been some 1000 fellowships previously handled through the National Research Council Fellowship Office. While these were largely supported from private funds the present tendency is strongly toward government grants, enabling the awarding of a much larger number of fellowships. Because of government regulations the techniques for selecting fellows have to be different in certain details from those used when private funds are supporting the fellowships. The last paper of the symposium was given by John C. Flanagan, director of the American Institute for Research at the University of Pittsburgh. Dr. Flanagan described some of the ambitious experiments under way to establish quantitative measures of the research effectiveness of individual workers. Techniques for these tests have been established and the individual test items are now in the process of validation. Attempts are being made to discover by the use of standard samples the effectiveness of the critical components of typical research jobs. While in the last analysis the supervisor must evaluate the effectiveness of his research colleagues, it is believed that his subjective judgments can substantially be improved in quantitative significance by the use of the instruments now being standardized. The addresses given in this session were summarized by C. W. Hawley, of the National Security Resources Board.

Henry H. Armsby, from the U. S. Office of Education, gave some preliminary figures concerning the enrollment of engineering students which were of great interest to the conference members. Dr. Armsby's data indicated an increase in enrollment in the current freshman year of about 15%, in comparison with the enrollment in the fall of 1950. There is a decrease of about 9% in the all-engineering enrollment this year. During the academic year 1950–51 there were about 42,000 bachelor's degrees granted, this being 10% higher than the previous estimates of 38,000.

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Society of Rheology

West Coast Section Meets at Berkeley

The West Coast Section of the Society of Rheology held its third annual meeting in cooperation with the Division of Mechanical Engineering of the University of California on the Berkeley Campus of the University of California on November 16, 1951. Several papers reflected the great influence of Henry Eyring's approach to the treatment of flow problems on the thinking of many rheologists. In a paper on the structure of the liquid state and the viscosity of hydrocarbons, R. J. Moore and Henry Eyring suggest that the molecules of normal paraffins are not only aligned parallel in the liquid state but experience hindered rotation up to temperatures substantially above their melting point. Discontinuities in the curves of volume, heat capacity, vapor pressure, and viscosity against temperature are shown to occur in many instances at points where geometrical considerations would just permit the onset of free rotation around the length axis of the n-paraffin chain.

Heats and entropies of activation for flow, in the Eyring sense, have been evaluated for various hydrocarbons in the respective ranges. On the basis of the observed values it is concluded that flow does not occur by evaporation, or "jumping" of individual molecules; instead, a new mechanism of flow analogous to that found in metals is proposed, involving movement of dislocations in the packed structure. Such flow involves cooperative movement of several molecules, the net energy of activation being the sum of the positive and negative energies involved in breaking and making

the several van der Waals bonds. Those molecules which cannot take part in cooperative motion because their complex structure precludes formation of a regular lattice should have high energies of activation (approaching $\frac{1}{2}$ E_{vap}) and positive entropies of activation for flow. This behavior is found with the complex molecules usually associated with lubricating oils at low to moderate temperatures; at high temperatures, where free rotation even of complex molecules could occur, the equations indicate a cooperative flow mechanism. The temperature at which the transition takes place appears to be related to viscosity index.

The viscosity of a high polymer melt was measured over a shear stress range between 50 and 3000 dynes/cm^2 and a temperature range from 15 to 170°C with an estimated precision of $\pm 1\%$ by T. Baron. The error introduced by energy dissipation was shown to be negligible in the present case. The data are well represented by Eyring's hyperbolic sine law. The physical significance of the deduced molecular parameters appears doubtful, however. Equations could be derived for the flow of non-Newtonian liquids in pipes and capillaries which should be useful for the interpretation of results and for process design purposes.

H. P. Lundgren interpreted the effects of chemical agents on the stress relaxation rates of wool fibers in terms of Eyring's flow theory and proposed a rheometric method for the determination of the distribution of stabilizing hydrogen bond which correlates well with the chemically determined distribution. This evidence further supports the view that hydrogen bonds provide stabilization against displacement of chains in protein fiber networks.

The effect of alpha solid solution alloys of aluminum on grain boundary relaxation in polycrystalline specimens has been investigated by J. E. Dorn and C. D. Starr over the temperature range 24–500°C by measuring the frequency of vibration of annealed wires and determining the modulus of rigidity. Of the alloys investigated, Cu-Al, Ag-Al, Ge-Al, Zn-Al, and Mg-Al, only the magnesium alloys were observed to alter the rate of relaxation of the rigidity modulus.

The interrelation of grain size (GS), frequency (ν), and temperature (T) on the ratio of the measured modulus to the unrelaxed modulus was also shown to be $G/G_u = f\ (\nu\ GS\ e\ Q/RT)$. Inasmuch as the activation energy Q for aluminum is, within experimental error, identical, the shift of the relaxation curves of magnesium alloys to high temperatures is attributable to an additional parameter A which appears to be a measure of the different ways the alloy can relax stresses across the grain boundary. Final correlation of the data is therefore based on the function $G/G_u = f\ (A\ \nu\ (GS)^2\ e\ Q/RT)$ which is also shown to be applicable to Ke's data for different metals such as aluminum and iron. A correlation is obtained between the results of this investigation and creep data on the same alloys.

Relations between the fine structure and the flow properties of lithium soap-oil dispersion were described by B. W. Hotten and D. H. Birdsall. They investigated the size and shape of lithium soap fibers obtained by dispersion of various lithium soaps in mineral oil. Strong effects of composition, environment, and of preparative technique could be observed. The texture and the consistency of the soap-oil dispersions (lubricating greases) could be correlated with the average surface area per unit volume of soap that had been computed from the electron micrographs.

The effect of viscosity changes upon the amount of bed-sediment transported in an open channel was discussed by L. W. Neubauer. The viscosity of the water was varied by varying the temperature and by the addition of sugar. The data obtained at elevated temperatures were obscured by the remarkably large influence of thermal convection on the sand flow pattern. A large decrease in sand movement resulted when the viscous sugar solution was used in laminar and in partly laminar flow. Sand transport in open channels appears to be a function of the "shear stress" at the wall. Bed movement begins only above a critical shear stress—still in the laminar regime—and increases with increasing Reynolds Number. Approximate expressions were presented relating the rate of sand transport to shear stress in the laminar and the sub-turbulent regime, respectively.

Professor R. G. Folsom, the Chairman of the Mechanical Engineering Division, provided for a most interesting tour through the hydraulics and the high vacuum supersonic wind tunnel laboratory of the University.

A. Bondi
Shell Development Company

Optical Society of America

Spring Meeting in New York

The spring meeting of the Optical Society of America will be held in New York City at the Hotel Statler on March 20, 21, and 22, 1952. The program, which is to include the usual group of invited papers by eminent authorities in several fields of current interest, will feature an Adolph Lomb Memorial Lecture by W. D. Wright of the Imperial College, London. The meeting will be open to nonmembers of the Society, and all interested persons are invited to attend. Nonmembers may secure copies of the program by writing to the Secretary, Arthur C. Hardy, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

Network Synthesis

Symposium in April

Modern network synthesis (audio to microwaves) is the subject of a symposium to be held on April 16, 17 and 18, 1952 at the Engineering Societies Building Auditorium (33 West 39th Street) in New York City. This symposium, jointly sponsored by the Polytechnic Institute of Brooklyn and the Office of Naval Research, will summarize the progress to date in the various fields