simple liquids of high degree of purity, for it has been shown that viscosity is in general a strong function of molecular structure in liquids.[5, 6] Consequently, it would be expected that the viscosity of lubricating oils under high pressures would be so intricately related to composition that analyses of data taken on bulk oils would be unsatisfactory. Previous investigations[3, 4] have shown, however, that the pressure coefficient of viscosity of mineral oils is greater than that of fixed oils, but there is no existing information on the relation of the pressure coefficient to the basic composition of a hydrocarbon oil which has been refined by various methods. It would appear desirable, if further tests are to be made on refined oils, that more about the chemistry of the oils should be known, especially their chemical and physical properties as related to the basic crudes and methods of refining. The purpose of the present investigation is to make a start in this direction, to study the effect of pressure and temperature on three hydrocarbon oils that have been refined previously in a known manner and tested extensively as regards their physical and chemical properties.

The three oils used in this investigation were provided by Professor H. A. Everett of the department of mechanical engineering who had previously studied[7] many properties of them in conjunction with Dr. M. R. Fenske of the Petroleum Refining Laboratory of this school. The oils were from Pennsylvania, Oklahoma, and California crudes, blended with bright stock and neutrals to have the same viscosity of approximately 0.4 poise at 130°F.

In order to study the effects of pressure and temperature, the rolling-ball viscometer of Hersey and Shore[3] was adopted as the most suitable type for these experiments. The rest of the pressure apparatus was of design similar to that developed by Professor P. W. Bridgman of Harvard,[8] and used by the author in previous investigations.[6, 9, 10] Professor Bridgman kindly loaned diagrams and cooperated with the author in the building of the high pressure equipment of the physics department, and Mr. G. V. Luerssen of the Carpenter Steel Company contributed steel for the construction of apparatus. This investigation was made possible by the interest and cooperation of the Pennsylvania Grade Crude Oil Association which generously contributed funds. The experimental observations were made by the writer in the high pressure laboratory of the department of physics.

Experimental Details

The rolling-ball viscometer and the auxiliary pressure apparatus are shown in Fig. 1. The viscometer was rotated through a known, small angle (10°) from its horizontal position by tilting the apparatus about an axis which was supported by an iron frame work. A handle attached to the upper part of the viscometer frame allowed the viscometer to be tilted by hand in either direction. In the viscometer, of dimensions used by Hersey and Shore,[3] a $\frac{1}{4}''$ ball bearing rolled down the bottom wall of an axial hole, 10 inches in length and 27/64 inches in diameter, when the viscometer was inclined to the horizontal. In order to measure the viscosity of a liquid in this apparatus, it is necessary to know the time required for the ball to traverse the length of the inclined path. To measure the roll time insulated electrical contacts with external connections were fitted into two steel plugs which were screwed into both ends of the viscometer to make it pressure tight. Both the plugs and washers were of conventional design used in high pressure investigations. It will be noted that when the ball reaches either end of its path, the relay circuit is completed through the viscometer and oil film to the ball which touches the insulated contact. The time of roll can be recorded by any of several means; in these measurements a calibrated stopwatch operated by hand was found convenient for the purpose. The arrival of the ball at one of the contacts was signalled by a simple vacuum tube relay device.

The viscometer with its supporting frame was surrounded by a thermostated water bath which two stirrers kept in constant circulation. The

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