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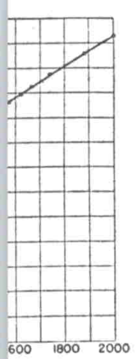

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late in the constrictions. When the pressure gradient was kept constant the permeability seemed to approach a steady value which was lower for lower gradients. A sharp increase in gradient always produced a sudden rise in permeability. Typical results of this type are shown in Fig. 3 where the permeability of a twice mudded core is plotted against flow for a section of its flow history.

It seems natural to think of the particles as forming bridges in the pore constrictions. These, then, might be expected to give way under a sufficient pressure difference and thus "open up" the core. With flow at a constant pressure gradient the permeability would be expected to approach a steady value when bridges had formed in most of the smaller constrictions.

The permeability to water was reduced by a single mudding to 50 or 60 percent of the original value but when the filter pack was kept from forming by removing it at intervals or by circulating the mud rapidly across the core face the

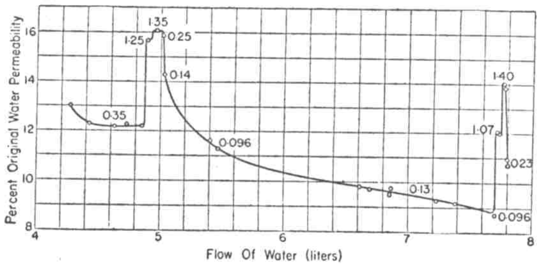

FIG. 3. Percent original water permeability of a twice mudded core *versus* flow. The pressure gradient across the core is indicated in atmospheres per cm by the figures. From 5 to 7.7 liters the decrease in gradient was gradual except for an increase to 0.18 atmospheres per cm at 5.5 liters.

reductions were much more than this. In one case the permeability was reduced to 4 percent of its original value in three successive muddings.

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The Effects of Pressure and Temperature on the Viscosity of Lubricating Oils

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The viscosities of three lubricating oils have been investigated at 100°, 130°, 210.2°F at pressures ranging from atmospheric to 4000 atmospheres (57,000 lb./in.²). While the oils were from fields widely separated geographically, their initial viscosities were matched at 0.4 poise at 130°F. At a pressure of 26,000 lb./in.² at 130°, however, the viscosities were strikingly different; the viscosity of the Pennsylvania oil increased 25-fold, and the Oklahoma oil 35-fold, but for the California sample the increase of viscosity was greater than 100-fold. The effect of pressure on the temperature coefficient of viscosity and the effect of temperature on the pressure coefficient of viscosity are discussed.

THE effect of pressure on the viscosity of fluid lubricants has been studied previously by several investigators. Experiments by Hersey[1] showed that the viscosity of oils increased considerably with moderate increase of pressure: further investigations by Hyde[2] at the National Physical Laboratory in England, Hersey and Shore,[3] and Kleinschmidt[4] in this country, increased our knowledge of the pressure effect of viscosity of oils of various kinds at several temperatures.

The increase of viscosity with pressure is a complicated phenomenon for even the so-called

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