ing about 36 per cent of the original crude mineral oil, is used without further processing as fuel oil, or is heated to a high temperature, until the wax distillate comes off, which contains lubricating oil and wax. Through the use of special separation methods, involving the application of refrigeration to the distillate, the wax is extracted from it and a crude lubricating oil is obtained from the wax presses. This crude lubricating oil is then redistilled, fractionated into light and heavy fractions, treated with sulfuric acid for the removal of undesirable impurities, and filtered through Fuller's earth for the removal of colored contaminations. Additional amounts of heavy lubricating oil are obtained by subjecting the residue left in the still to various treatments with chemicals, until the waxy constituents and the lubricating oils are separated with the help of centrifugal separators. Through these successive steps of fractionation, crude mineral oils are divided into gaseous and liquid paraffins; olefins and poly-olefins (which are fractionated into gaseous and liquid paraffins, naphthenes, and lubricating oils; while the crude naphthenes are split into paraffins, naphthenes, and lubricating oils with reduced hydrogen content); and solid paraffins (which are fractionated into liquid paraffins, olefins, and lubricating oils). The naphthenes are cyclo-paraffins (cyclohexanes-cyclohydrobenzols; five and seven member ring compounds), some of which are unsaturated, cyclic compounds (anthracenes, naphthalenes, and phenanthrenes). The high boiling hydrocarbons of this group are polynaphthalenes, aliphatic and cyclic unsaturated hydrocarbons (Gruse; and Lewkowitsch).

During the refining process the oils are treated with sulfuric acid, which later is neutralized by bleaching with caustic soda, and are subjected to intermediate washings. This processing has the following effects upon the oils: 1. precipitation or solution of sulfur compounds, resins, and petroleum acids; 2. combination of acid with nitrogen bases and some unsaturated hydrocarbons; 3. polymerization of unsaturated hydrocarbons; 4. sulfonation of aromatic hydrocarbons; 5. oxidation of some unstable hydrocarbons; 6. hydrolysis of olefins and polymerization of olefins; and 7. removal of unsaturated hydrocarbons (diolefins and acetylene), or their conversion into more stable forms (Heller). During the distillation process at high temperatures, aromatic substances (anthracenes and phenanthrenes) are generated from aliphatic ones originally present in the crude oil. It is for this reason that distillation products may display biologic properties different from those exhibited by the raw material. Crude Californian oils have been found to be noncarcinogenic, while some of their products of fractionation and refining were shown to possess carcinogenic qualities (Twort).

Shale Oils. The distillation of oil from oil-bearing shales, which are hard, black, non-crystalline rocks resembling in appearance pitch, started around 1850 in the West Lothian district of Scotland. Up to that time vegetable and animalic oils had been used exclusively for the lubrication of the machinery