In the highly competitive forest products industry greater efficiency and less waste have resulted from the intensive research that has been carried on in Canada in the last quarter-century. A number of basic changes have taken place in the methods of bleaching pulp and these developments have not only increased the efficiency of operations but have resulted in such new products as vanillin, yeast and industrial alcohol from the sulphite liquor, and certain plastics from the lignin. Considerable attention has been given to improving forest-operation practices and to finding means of utilizing the waste products. There has been a great improvement in logging and lumbering methods as well as mill processes, and much of what was formerly waste material is now being used to advantage. Two pulp mills in British Columbia are now operating solely on waste products of other phases of forest operations and other similar mills are planned. A large number of uses for saw-mill waste have been found also.

The mining industry in Canada has benefited greatly from research and owes much of its present prosperity to the improved processes and to the new uses for its products that have come from industrial research. For example: when the whole nickel industry faced a grave situation after the First World War (the chief use of nickel at that time was for the manufacture of armaments, and disarmament was the order of the day) research developed new alloys with important commercial use and put the nickel industry on a sound peacetime basis. The recovery of selenium as a by-product of the smelting of certain copper ores away back in 1931 has become an important industry itself and has made Canada a major producer of this element. Sulphuric acid for use in making fertilizer was first produced from waste smelter-gases some years ago and a new plant to produce liquid sulphur dioxide for use in the pulp and paper industry from smelter gases of the Copper Cliff refinery is being built at present. A process of electrolysis developed at the Trail smelter some time ago enabled zinc to be produced at a lower cost while a method of selective flotation developed to handle the complex lead-zinc ore of the Sullivan Mine was so successful that its use is now widespread in the concentration of similar ores.

A separation process developed jointly by the Federal Department of Mines and Technical Surveys, the National Research Council and the Eldorado Gold Mines Company made possible the development of Canada's radium industry. Work done in the laboratories of the Federal Bureau of Mines led directly to the establishment of the mineral wool industry in Canada, which, in 1951, comprised 14 plants, provided employment for about 1,000 persons and produced goods valued at $11 million. This bureau also developed a process for recovering magnesia and hydrated lime from mineral deposits at Wakefield, Quebec, which resulted in the establishment of a plant there to produce these materials for fertilizer and chemical uses. Research found a way of obtaining magnesium from Canada's abundant supplies of dolomite, thus paving the way for a commercial development. More recently, the Department of Mines and Technical Surveys, has devised processes for using a special shale in the manufacture of building blocks and for using a local silica deposit in the making of glass. In both cases commercial development will probably follow.

Many of the chemicals now being produced in Canada or scheduled for production in the near future are the direct results of industrial research. For example, the $1-3/4 million lignosol plant at Quebec City opened last June is the result of the discovery of a process to produce lignosol - which is used as a soil stabilizer, a binder and a plasticizer - from the spent sulphite-liquor