the manufacture of explosives. In the process used, which was originally developed in Germany, there is employed a technique, viz., the application of very high pressures to bring about chemical reaction between gases, which is becoming increasingly important in industrial chemistry. Ammonium phosphate, a highly concentrated fertilizer containing both nitrogen and phosphorus, is also now being made at Trail, while triple superphosphate fertilizer is being made there and at Beloeil, Quebec. The effect of these developments is reflected in the jump in the production of fertilizers in Canada from $2,504,573 in 1930 to $4,231,598 in 1933.

The utilization of the deposits of sodium sulphate occurring in dried-up lakes in Saskatchewan has been undertaken seriously in recent years. The removal of the 62 per cent of water present in the crystals presented peculiar technical difficulties, which have, however, been overcome; and the dry salt, known as salt cake (because it was originally secured as a residue when common salt was treated with sulphuric acid in order to produce hydrochloric acid) is in part being shipped to the Sudbury district, where, by treatment with sulphuric acid, it is converted into sodium bisulphate, known as nitre cake (because it was originally secured as a residue when Chile nitre was treated with sulphuric acid in order to produce nitric acid) for use in the production of nickel from its ore. Another part of the salt cake is being used in glass manufacture.

The effect of this new development, based on the utilization of domestic resources, is clearly seen in the fact that the production of salt cake in Canada has risen from 1,038 tons in 1924 to 66,900 tons (estimated), valued at $519,000, in 1934; and that imports of salt cake have dropped from a maximum of 42,333 tons ($686,458) in 1927 to 2,595 tons ($34,371) in 1933, while imports of nitre cake have dropped from a maximum of 80,872 tons ($1,081,984) in 1929 to 574 tons ($15,989) in 1933.

Sulphuric acid is so widely and extensively used in modern industry that it has been said with some justification that the per capita production of the material in any country is an index of industrial development there. The most interesting advance in Canada in regard to this staple commodity is that, whereas formerly the raw material used was exclusively either pyrite or imported sulphur, in 1925 a plant was put into operation at Coniston, near Sudbury, in which waste smelter stack gas, containing sulphur dioxide, is used as the raw material for sulphuric acid manufacture. This was followed more recently by a large plant at Trail also using smelter gas. Another development of note concerning mineral acids is the production in 1925 for the first time in Canada, at Sandwich, of hydrochloric (muriatic) acid, not as formerly from common salt by treatment with sulphuric acid, but from the hydrogen and chlorine gas derived from cells in which brine is subjected to electrolysis for the primary purpose of producing caustic soda.

Very recent developments are the production of calcium chloride by the Brunner, Mond Company at Amherstburg, Ontario, a material imported in recent years, chiefly for laying dust on roads, to the extent of about $500,000 a year; and the erection at Cornwall, Ontario, by Canadian Industries Limited of a new plant for the production of chlorine — so important as a bleaching agent in the pulp and paper industry — and caustic soda by the electrolysis of brine. The manufacture at Hamilton by the last-mentioned firm of liquid sulphur dioxide, used as a refrigerant and in water treatment, is another forward step of the last year or two. The design of the plant was based on experimentation carried out in Canada.

Other products newly made in Canada for the first time are sodium chlorate, of growing importance as a weed killer, trisodium phosphate, an alkali used in many cleaning preparations, and calcium acid phosphate, used in baking powders. The manufacture of these has lately been undertaken by the Electric Reduction Company, Buckingham, Quebec.

Based on Canadian Research

It is particularly gratifying to record the developments for which Shawinigan Chemicals Limited, Shawinigan Falls, Quebec, have been responsible during the last decade, because they are based on research carried out in Canada, and not, as in a good many other cases, on imported research results. Using hydro-electric energy for the production of calcium carbide, which serves as a starting-out point, the Company, thanks to their admirable research laboratory, have developed the manufacture of a range of synthetic organic chemical products, the latest of which is a remarkable series of synthetic resins, the vinyl acetate resins, which are exciting much interest both in Canada and outside and seem to have a wide field of usefulness. Thanks to persistent research directed toward process improvement, the Company occupy a strong position in regard to the manufacture of synthetic acetic acid, and it is understood that it was because of their special technical knowledge that they secured an interest in a firm founded a few years ago to manufacture similar products in the United States.

Another interesting advance initiated by research carried out in Canada concerns oil refining. This is the use of phenol (carbolic acid) as a refining agent in the production of lubricating oils. The process was developed in the laboratories of the Imperial Oil Company at Sarnia, Ontario, and has, it is understood, lately been put into operation by refineries in other parts of the world.

Rayon and Cellophane

The tremendous recent growth in the use and hence the manufacture of Cellophane must have forced itself on the attention of everybody. In the United States factories producing this new material ran night and day throughout the depth of the depression. A plant for the manufacture of Cellophane in Canada, at Shawinigan Falls, Quebec, started operations last year.

Noting this remarkable, transparent wrapping material, the man in the street is liable to reflect merely, "Ah, the chemist has turned another trick!" Little does he realize the years of persistent research which have gone to making this product a commercial reality. The original discovery upon which the manufacture of Cellophane and most of our rayon depends was patented by two British chemists, Cross and Bevan, as far back as 1892. This discovery was a method of dissolving the apparently insoluble material cellulose (wood pulp or cotton linters) to form a solution which when injected into a bath of acid regenerates the cellulose in the form of threads or sheets as desired. Yet many years of pertinacious effort were needed before the process could be operated on a commercial scale to yield satisfactory products.

Rayon made by this process did not become an important factor in the textile field until the second decade of this century and has experienced its great growth only during the last ten years. Cellophane is a still more recent growth. The world production of rayon grew from 64,500 metric tons in 1924 to 284,000 tons in 1933. Rayon was first produced in Canada, at Cornwall, Ontario, in 1925, the viscose process being used. In 1927 a plant for the production of acetate rayon was established at Drummondville, Quebec. The volume of production of rayon in Canada has steadily grown and in 1933 was about 3,500 metric tons. It is gratifying to note that the acetic acid used for acetate rayon manufacture in Canada is made at Shawinigan Falls, and that the production in Canada of the sulphur dichloride employed was undertaken a year or two ago by Canadian Industries Limited.

Reference may be made in passing to the amazing growth in rayon manufacture in Japan. In 1924 Japan produced only 681 metric tons; in 1932 it produced 29,270 tons, and was the fifth largest producer, being surpassed only by the United States, Italy, Great Britain and Germany; in 1933 it produced 40,875 tons, and had jumped to second place, being exceeded only by the United States. Not on this line alone is development taking place in Japan at a remarkable rate. Japan is, for example, now making the dyestuffs required for its textile industry. Whereas before the Great War Japan, like Canada today, imported all the dyes used, today there are in operation forty-two dye manufacturing plants, producing 90 per cent of the country's require-

Expansion in the Chemical Industry

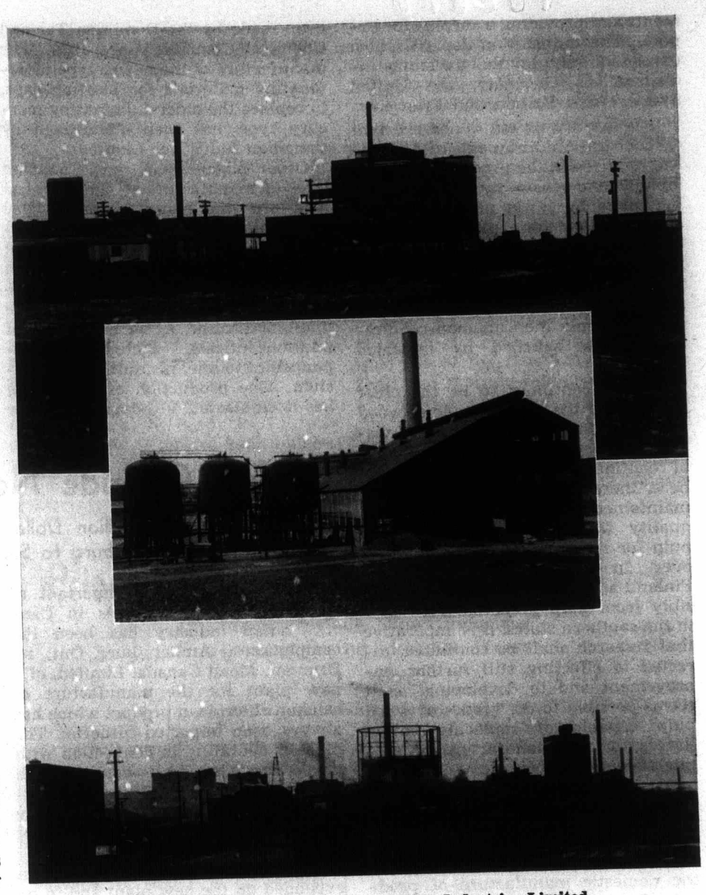
AS A STRIKING illustration of the manner in which the manufacturer of chemicals and chemical products has been expanding in Canada of recent years, the following list of additions to the manufacturing capacity of Canadian Industries Limited will be illuminating.

WORKS AS AT DECEMBER 31, 1927

Brownsburg, Que.	Ammunition
Beloeil, Que.	Commercial Explosives
Nobel, Ont.	Commercial Explosives
Shand, B.C.	Commercial Explosives
Brownsburg, Que.	"Pyralin"
Toronto, Ont.	Paint and Varnish
New Toronto, Ont.	"Fabrikoid"

PLANTS ADDED SINCE 1927

1928	Black Powder	Shand, B.C.
1928	By-Product Ammonia	Toronto, Ont.
1928	Salt, Chlorine, Caustic, Hydrochloric	Sandwich, Ont.
1928	Sulphuric, Hydrochloric, Glaubers Salts	Hamilton, Ont.
1928	Paint and Varnish	Regina, Sask.
1928	Mixed Fertilizers and Superphosphate	New Westminster, B.C.
1928	Ammonia Oxidation	Beloeil, Que.
1929	Synthetic Ammonia	Sandwich, Ont.
1930	Sulphuric and Nitre Cake	Copper Cliff, Ont.
1930	Fertilizers and Superphosphate	Beloeil, Que.
1930	Fertilizers and Superphosphate	Hamilton, Ont.
1930	Primers, R.R. Fusees, Duco Shot-shells	Brownsburg, Que.
1931	Fertilizers	Halifax, N.S.
1931	Liquid Sulphur Dioxide	Hamilton, Ont.
1931	Smoked Salt	Sandwich, Ont.
1932	Sulphur Dichloride	Sandwich, Ont.
1932	"Cellophane" (the registered Trade Mark of the Du Pont Cellophane Company Inc., designating Cellulose Sheets and Films manufactured in Canada, under contract, by Canadian Industries Limited)	Shawinigan Falls, Que.
1934	Commercial Explosives	Selkirk, Man.
1934-5	Hydrogen Peroxide	Shawinigan Falls, Que.
1934-5	Caustic, Chlorine Hydrochloric	Cornwall, Ont.



Three of the New Plants of Canadian Industries Limited.
At the top, plant of the Paint and Varnish Division at Regina; centre, the sulphuric acid plant at Copper Cliff, Ont.; bottom, the synthetic ammonia plant at Sandwich, Ont. Altogether this company have added twenty new plants to their list since 1928.