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EDITORIAL

Imperial Oil’s annual report discloses a number of new records for 1947. In quantity and value, sales were the greatest in the Company’s history; an important oil field was discovered and its development speeded; capital outlays and ordinary expenditures were greater than in any previous year; employment and wage and salary levels were at new highs and there was further progress in binding the traditionally good relations between management and employees and Company and customers.

The manifold activities of the most active year in Imperial’s history produced an earning that was equivalent to $2,350,000 for each gallon of products sold or, stated in another way, a profit of 6½ cents for each dollar of goods and services supplied. This profit per gallon contrasts interestingly with the nine to 13 cents per gallon of provincial tax which is imposed upon gasoline; and the 6½ cents figure will be revolutionary to people who think that profits from sales are many times greater.

Total sales of all products were 1,662 million gallons, 20 per cent. more than the record set in 1946. This was achieved by refining an average of over 4,200,000 gallons of crude oil per day and by large imports of finished products to supplement the Company’s own refinery production despite the fact that the refineries operated at the highest possible rate.

Further records were made in transportation and the Company’s tanker fleets moved more than 2,024 million gallons of crude and products on the high seas and on coastal and inland waters. This was 390 million gallons more than in 1946.

Through the Company’s exploratory efforts, Canada’s latest and possibly greatest oil field was brought into being at Leduc. This discovery not only stayed the downward trend of domestic production but gave added impetus to the search for new fields, so vital to Canada’s future economy. On its own behalf at Woodend, and in conjunction with others at Bantry, the Company obtained encouraging evidence of further success in Alberta exploration which future development will evaluate.

All this has been accomplished in spite of decided shortages of materials badly needed for new construction, plant renovation and improvement, for transportation facilities by land and sea, and for the increase of marketing and distributing outlets and exploration and development drilling.

Extraordinary steps have had to be taken to meet such emergencies and supply the necessary financing for the Company’s efforts to ensure Canada’s self-sufficiency in oil. The report indicates progress towards this goal in the face of many difficulties and holds promise of future achievement.
Canada's Oil Supply

The oil industry throughout the world is engaged in the greatest exploration, expansion and development program in history and this is of great importance to Canada.

Is North America going to run out of oil?" is a question that is being asked with increasing frequency. Here in Canada, where we import a major part of our requirements, it takes the form: "What about our oil imports from the United States?"

American petroleum experts say: "No! We are not going to run short of oil. The deposits of oil in the ground that are already known to exist will provide supplies for many years. Despite high withdrawal rates, these proven reserves are being maintained because exploration is making available new sources of supply. At the same time, the results of research in oil laboratories will add to our supplies by synthetic methods. The supply difficulties of today are temporary."

The special problems faced by the oil industry of this continent are the combined result of limitations imposed by the war and post-war periods, and by the tremendous increase in the demand for petroleum products. The industry has had to supply unprecedented quantities of oil at a time when general conditions retarded expansion.

In recovering from the greatest oil consuming war in history the industry found its refineries required modernization and expansion. During hostilities normal replacement and expansion could not be undertaken because materials were needed for the fighting lines. After the war, equipment for exploration and production, for manufacturing, transportation and marketing all were urgently needed.

Progress in meeting these requirements has been made but shortages of materials, particularly steel, have continuously delayed construction programs. In spite of this the industry's great program of exploration and expansion is already showing encouraging results.

The industry is providing more products than ever before in its history. Demand still outruns supply, however, and this brings the supply question to the forefront again and again.

Canada and the United States share the same supply problems, but in the Dominion there has been the added concern that we must depend upon our neighbor for a substantial part of our oil imports.

Canada imports more than 90 per cent of her petroleum requirements. About half of our oil comes from the U.S. although the amount we receive is only about 2.9 per cent of American production.

South America is our other main source, supplying about three-eighths of our oil needs. Promises of future supplies from there are encouraging.

Our own oil fields furnish less than 10 per cent of our requirements. While Leduc and other recent discoveries in western Canada give hope of increased domestic production the development of these areas requires time.

As the most highly industrialized nation in the world, the United States has the world's greatest need for the 5,400 petroleum products that serve civilization. Ships, trains, cars, motors, oil burners and aircraft are a few of the more familiar oil consumers. All of these have increased in number in the U.S. since the end of the war.

The United States is a country rich in petroleum resources but demands for American oil, both at home and abroad, are the highest in history. Last year Canadians used 96,000,000 barrels of petroleum products but this amount is dwarfed by U.S. figures. In the same period the United States consumed approximately 1,989,515,000 barrels, an increase of approximately 182,500,000 barrels over the previous year. The U.S. today uses more oil than was required by all the world 10 years ago. In addition the demands of war-torn Europe have been an added drain on U.S. supplies.

Canadian Requirements

On the Canadian side the consumption of oil products kept pace with that of the U.S. Canada is second only to the U.S. in per capita consumption of oil products, although because of her comparatively small population the Dominion's consumption equals only four per cent of her neighbour's. Last year Canada consumed about 261,000 barrels of oil daily.

Stated another way, Canadian consumption of products rose from about 50,000,000 barrels in 1939 to 98,000,000 barrels in 1947. Fuel oil consumption increased threefold during the same period.

Sources that supply crude oil to Canadian refineries vary with the provinces. The following breakdown is based on 1947 figures:

British Columbia crude imports come mainly from California by tanker. A comparatively small quantity comes from Colombia and Venezuela. Even Alberta, Canada's oil province, imports 20 per cent of her refinery requirements from the United States, but draws the remainder from her own oil fields.

Sources of Canadian crude oil supply...by provinces

SOURCES OF CANADIAN CRUDE OIL SUPPLY...BY PROVINCES

BRITISH COLUMBIA

ALBERTA

SASKATCHEWAN

MANITOBA

ONTARIO

MANTITIMES & QUEBEC

C A L I F O R N I A

CENTRAL U.S.A.

SOUTH AMERICA

U.S. AMRICA

NORTH AMERICA

U.S. GULF AREA

Dominion Bureau of Statistics figures for 1947

IMPERIAL OIL REVIEW

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Saskatchewan refineries are largely dependent upon foreign sources of oil, the solution to her supply problem is closely tied up with the world oil situation.

The World Picture

The countries of the world move on oil today as never before in history. This is most decidedly the case with the eastern Hemisphere. And, of course, not the atomic age. All the ingenious mechanical aids that distinguish our way of living and working must have oil to function. Oil for the wheels of progress is more than just a slogan—it is a vital necessity.

CRUDE OIL IS 91% IMPORTED

Because Canada is largely dependent upon foreign sources of oil, the solution to her supply problem is closely tied up with the world oil situation.

Though the world supply situation today is tight, petroleum experts repeatedly emphasize that there is no basic shortage of oil. Instead, the problem everywhere centers around sharply increased demands aggravated by the lack of skill and equipment caused in large part by the war. The continuing military requirements for occupation troops and defense equipment in Europe must be met. In addition there is a large European demand that must be supplied for the reconstruction of war-shattered industries and cities in European countries.

Assistance is expected from the Middle East which has the world's greatest oil reserves. Known reserves in this area, which includes Iran, Iraq, and Saudi Arabia, are sufficient to support an estimated production of six million to seven million barrels daily although only 800,000 to 900,000 barrels daily are currently being produced. Transportation and field facilities are being expanded for increased production in the Middle East which is the natural point of supply for Europe.

Middle Eastern oil should become available to supply Eastern Hemisphere requirements. The increased supplies will particularly aid Europe which is now largely dependent on the U.S., the Caribbean and Venezuela. In turn this will aid Canada and the U.S. because a larger part of the oil from these areas can be allotted to supply the needs of our own continent.

Oil fields in the Far East are now recovering from the effects of war and enemy occupation but it is not anticipated that any increase in production in that part of the world will be felt here.

The known but untested sedimentary basins (the areas most likely to contain oil) throughout the world are believed to contain more oil than all those that have already been developed.

What Is Being Done?

The industry throughout the world has undertaken the greatest expansion program in history. Investments for new development in the 1947 and 1948 period will total over five billion dollars. This represents the expenditure of nearly one-fifth of the money invested by the industry up to the end of 1946. The oil companies are turning out more than their current earnings in their efforts to enlarge the sources of supply to meet today's pressing demands.

New wells are being drilled as fast as materials can be secured. For instance, it is expected that this year, 54,811 new and oil wells will be drilled in the United States. This is an increase of five percent over 1947.

These new wells will cover only a small percentage of the known untapped areas. The U.S. has to date produced in excess of 50 billion barrels of petroleum and known reserves of at least 23 billion barrels of recoverable oil are still in the ground in explored areas. It is estimated that if only one percent of the known untapped areas were brought into production it would supply another 50 billion barrels.

It should be pointed out, however, that large amounts of capital are required for these activities. The oil business is essentially a "risk" business and exploration is expensive and often discouraging. Even with present scientific methods the results of long search and drilling may only be to drill a dry hole. To meet the transportation shortage, a precedent setting volume of pipe line construction is under way. More than 8,000 miles of new lines for gas and oil were being placed in operation during 1947. Of this amount 7,953 miles were in the U.S. This year it is expected that 10,000 miles will be in operation. Large scale pipe line construction is expected to continue for another four to five years.

Construction of oil tankers is going ahead. On July 1, 1947, 124 tank ships with a dead weight tonnage of 1,729,000 were under construction. In January of this year in the United States negotiations were being made for the construction of 13 "super" tankers by these major oil companies. These fast and improved vessels will each be capable of carrying 200,000 barrels of petroleum products.

A Bright Spot In Canada

The bright spot on the Canadian scene is the Leduc oil field. Imperial-Leduc No. 1 became the discovery well of the Leduc field on February 13, 1947. Before the year was out Leduc had played a major part in reversing the decline in Alberta's oil production. In that period the discovery well alone produced 42,564 barrels of crude.

The total production for the Leduc field to the end of 1947 was 373,450 barrels. The average daily production was 3,222 barrels. Leduc is like a youngster just learning to walk. On its first birthday production had reached 5,000 barrels a day and it will increase quickly for new wells are being drilled as rapidly as supplies can be obtained.
The Leduc discovery has meant the establishment of a new refinery at Edmonton. Imperial Oil bought the refinery at Whitehouse, Y.T. It is now being dismantled and the parts transported 1,350 miles to be re-erected.

The new refinery at Edmonton will be in partial operation by next July. Its capacity is to be 4,000 to 6,000 barrels a day. A pipe line, which now brings Leduc crude to a rail spur at Nisku, will be extended to the refinery.

Early this year Henry H. Hewetson, president of Imperial Oil, announced that potential production in the Edmonton area may enable Leduc crude available to Saskatchewan and possibly Manitoba. The Company also is considering the possibility of installing a 500-mile pipe line from the field to Regina. The cost of such projects is difficult to determine at this stage without the benefit of extensive surveys, but it might be about $30,000,000. Their undertaking will depend on new discoveries from the intensive exploration program now under way in the west, because the Leduc field, while encouraging, can supply only a small part of the oil needed.

Mr. Hewetson also said that Imperial will spend about $20,000,000 during 1948 in development of the Leduc field and in further exploration for new oil fields in Alberta.

What About New Oil Fields?

Before the discovery of Leduc, Imperial had spent millions of dollars in exploration. Discovery of the new field has stimulated the search for oil in Canada and many companies have joined the industry's intensive search for new fields.

Imperial also has an extensive exploratory program under way in southwestern Ontario, where more than 100 wells have already been drilled. This program has resulted in the discovery of a gas-and-oil field and a gas field.

Two recent discoveries in southwestern Ontario indicate that another minor oil field has been found, and perhaps another gas field. Production from this area is small but an important contribution in today's short supply situation.

Conclusion

The Canadian petroleum picture is a comparatively small part of the world's panorama, but by itself it is important in the eyes of those it concerns. Canadians are engaged in a constant, but winning struggle against great odds. The odds are the material shortages, the increasing demands and lack of time.

Because of Canada's dependence on petroleum the discovery of Leduc is of national importance. By obtaining additional supplies from Canadian wells the Dominion will be able to save many vital U.S. dollars that would otherwise be used in purchasing oil in the U.S. The Leduc field both by its geographic location and productivity also is highly regarded by those concerned with military defence strategy.

The oil industry in Canada, in the United States and in the world at large, is leaving no stone unturned to meet the demands of today and the future. There is plenty of oil, and it will become available as rapidly as the industry can throw off the physical limitations which shackle it.

Field Report

Drilling rigs are at work for Imperial in areas from the east coast to the foothills of the Rockies. At the beginning of April, when this was written, a survey of these activities provided the following information:

At present the Company now has eight seismic crews, two gravity meter crews and one magneto-meter crew engaged in geological exploration in western Canada. Among Imperial is sharing in the cost of operating two other seismic crews.

The Leduc area continues to be the centre of very active drilling operations. Imperial has completed 40 wells in the area. Thirty-eight of them are producing oil; one is a gas well; and one, Imperial-Leduc No. 94, was abandoned early in March as a dry hole.

This was Imperial's first failure in over a year of drilling in the Leduc area. It was felt that this location might mark the limit of the field in a south-easterly direction. However, Imperial-Leduc No. 9, a semi-wildcat well drilling a mile east and a half-mile south of the known limits of the field, was completed as an oil producer during March. Sufficient data are not available at present to know whether this is a separate pool or an extension of the Leduc field.

Across the North Saskatchewan River, about three miles north of the Leduc field, the Company brought in Imperial-Woodbend No. 1 well on January 29th. Two additional wells are being drilled in that area at present. Whether or not this is an extension of Leduc or a new field has not been determined.

Imperial is currently employing 18 contract drilling rigs in the Leduc-Woodbend area, 17 of which are drilling and one being rigged up at a new location. Imperial also has a rig drilling in the Blackfoot pool of the Lloydminster oil field on the Alberta-Saskatchewan border.

Company-owned rigs are employed on widespread exploratory drilling tests in other areas. Drilling will begin soon at Imperial-Clyde No. 1, 35 miles north of Edmonton; Imperial-Edmonton No. 1 is working 10 miles southeast of Leduc; Imperial-Toffield No. 1 is 45 miles east of Leduc; Imperial-Fedorah No. 3, 25 miles north and east of Edmonton; Imperial-Valmer No. 1 located 10 miles north of Edmonton and N.F.-A. Musking No. 1, in the foothills of the Rockies, a joint venture in which Imperial has a one-fifth interest is now below 8,800 feet.

The California-Standard Oil Co. and Imperial are planning to drill another well near the Barrney discovery well which is about 100 miles east and south of Calgary.

In drilling for oil, fluid mud is used to take away the rock chips cut by the drill bit. Here a roughneck takes a sample of the mud in a Marsh funnel to carry out a viscosity test.
Famed in legend and story, this Yukon community is progressive and ambitious.

WHITEHORSE, bucolic community of the Yukon Territory jumped from 500 population to 50,000 at the height of World War II. Since then it has lost 40,000 inhabitants.

But the citizens of this town in the land of the midnight sun take such developments in their stride. They have an answer which reflects their northern optimism.

"Mister," one old-timer remarked, "it took us 44 years—from '38 to '42—to settle for a standing population of 500. That 50,000 binga did us a lot of good. Okay—but just remember that today we're crowding 5,000 and still mushing in the right direction."

Whitehorse also survived an earlier boom that was just as strenuous. That was in the roaring days of the Trail of '98. The settlement on the banks of the Lewes River was then the jumping-off place for thousands of adventurers striking out for the Klondike gold fields.

A town with a past, Whitehorse lives in the present. She possesses all the facilities of a modern community and is surrounded by natural resources that assure her of a bright future.

Gold comes in substantial quantities from her mines but the rough and tough methods of the Trail of '98 have been replaced by modern mining operations. Fur trading is still a basic industry but gone are the indiscriminate trappings of the last century. Motor vehicles run where dog teams were once supreme.

The war in the Pacific placed Whitehorse in the front line against Japanese aggression. Defence measures brought great changes and thousands of war workers and military personnel to the town. Modern airfields were constructed, the Alaska Highway connecting Whitehorse with Edmonton was pushed through the wilderness and rapid communication facilities linking the north with the rest of the world were among the permanent improvements.

From the earlier boom Whitehorse has retained the adventurous spirit that animated the Trail of '98. It still prevails and colors the lives of the citizens in this modern community.
WHITEHORSE...
A Centre of Trade and Commerce

The old and the new are reflected in the industries of Whitehorse and all the Yukon Territory. Fur trapping and trading are the oldest occupations and are in a flourishing condition. The Hudson's Bay Company opened the first trading post in the Territory in 1842.

Gold, which is synonymous with the name Yukon, is the principal metal. But silver and lead are also produced and today there is widespread interest in copper deposits. Engineers are now probing the potential of the area for hidden wealth.

Wartime aviation left its mark in the chain of RCAF operated airfields known as the Northwest Staging Route. Now, citizens from the U.S. and Canada can fly direct to Whitehorse for fishing and hunting. But tourists in Whitehorse often prefer the stern-wheelers that ply the Lewes River, along the Trail of '88.

Gold is the principal source of Yukon wealth. Dampening and weighing the contents of a prospector's pouch is exacting but routine work for A. E. Hardy, a Whitehorse branch bank manager.

Whiteshores is a clearing point for Yukon furs. Fur trading and trapping is the Yukon's oldest industry. Robert Anish, Whiteshores fur trader, above, learned his trade in England.

The Whiteshores press faithfully reports the local scene and supplies readers with thoughtful editorial comment. Editor is Horace Moore, seen here backed by a well-stocked library.

These passenger and cargo stern-wheelers are reminders of the pioneer Yukon days. In summer the boats ply along the Lewes River as they did half a century ago. Hoisted ashore for the winter they are repaired to be ready for the navigation season.

Whitehorse airport is operated by the RCAF. Here in the control tower, P/O E. R. Austin of Ottawa and Vancouver and LAC T. G. Walsh of Toronto communicate with an airborne plane.

Volunteers from Canadian Army units that maintain the Alaska Highway operate the radio transmitter. The call letters are on the wall above. Sgt. Tommy Alexander and W.O.2 Ted Gray...
WHITEHORSE...
An Active Community

WHITEHORSE feels she holds the reins in the Territories and Canada's new northwest. Many citizens will tell a visitor Whitehorse and not Dawson City should be the capital of the Yukon. Citizens stress the strategic position of Whitehorse along the Alaska Highway and its proximity to other transportation facilities in the Yukon.

Much of the prevailing optimism in Whitehorse, as in the remainder of the Yukon, is based on the Alaska Highway. Now open to tourists, a steady flow of Alaskan-bound Americans are expected to travel over it this season.

This winter the Highway has been the scene of a unique operation, the transfer of thousands of tons of refinery equipment from Whitehorse to Edmonton.

Visitors to Whitehorse will find in the hustle and bustle of the community life many links with their own home towns.

Service clubs play an active part in the community life. Here Bill Hamilton, president of the Whitehorse Lions Club, is addressing members on the club's plans for 1948.

Children of the Whitehorse Indian Mission frequently enjoy Sunday School parties like this. Here Rev. H. J. Lee of Gospel Church takes movies with the aid of Jack Meek, Indian Agent.

Artistic Frances Boyce, Whitehorse waitress, is seen finishing a portrait of Smokey Gray, truck driver on the Alaska Highway.

Lady Luck's smile has always been courted in the Yukon particularly by the men who frequent the gambling houses. Games like the above are strictly supervised by operators in contrast with the old days when everything was "wide open."

Whitehorse has three churches. The most famous is the "Old Log Church" built in 1900. Robert Service's "Songs of a Sourdough" were penned in the study of this church of which he was a warden. Good choirs, like the above, are the rule.
WHITEHORSE...
Home of a Vigorous People

The grim, uncompromising Yukon that Robert Service described at the turn of the century, is a different country now.

In those days Whitehorse was a conglomeration of tents and shacks, a stopping-off place with an uncertain future. The tents are gone. Long ago the shacks were replaced by permanent dwellings and stores. In many respects life became as one with the other towns and communities of Canada.

As the largest centre of population in the Yukon Territory, Whitehorse enjoys a stability that even the boom of the war years did not dislodge. She looks back on the wartime boom with respect most surely deserved, but recalls the population figure of 50,000 at one period as though such fantastic variances are part of the scheme of things and should not be allowed to upset basic living.

As key-point in relation to highway, railway, airlines and river transport, Whitehorse has every reason to feel that she is destined to become, before very long, the metropolis of the new Canadian far north-west. If you are in doubt, you have only to ask any citizen of Whitehorse.

The New Look in Whitehorse, as worn by Mrs. I. H. Dennisson. She is seen here in the line-up waiting her turn at the bank. Porkos and mukluks are standard attire among the women in the Yukon. The trim outfit worn by Mrs. Dennisson is incontestably the style of the day.

Great piles of wood like the above line Whitehorse streets during fall and winter months. This scene might suggest extreme cold but Whitehorse does not have as severe winter conditions as other sections of the Canadian northland.

"Stampede John" Stenhagen earned his name in adventure ways. He was in the vanguard of almost every important gold stampede in the Yukon and Alaska. He is seen on the sample of the Whitehorse "sky scraper" as this rustic apartment house. The idea of the house is the result of heating problems and the builder figured the stove in the lower room will heat all the floors.

The Robert Service code for the north can be seen on the wall behind R. Gordon Lee, who is Whitehorse district member of the Yukon Territorial Council. Mr. Lee operates a specialty shop selling novelties to tourists who are flocking to Whitehorse.

This is the law of the Yukon. That only the strong shall thrive. That sure the weak shall perish. And only the fit survive. Desolate, damsel despairing, Crippled and palsied and slain, This is the way of the Yukon. -'Tis how she makes it plain.
The Cartagena Water Famine

QUICK ACTION by the Andian Pipe Line and Tropical Oil companies in setting up an emergency pipe line recently saved the citizens of Cartagena, Colombia, from a prolonged water famine which had threatened to create an outbreak of disease and epidemics.

Landslides brought on by heavy rainfalls smashed a section of the water mains leading into the city. A few hours after the disaster, Cartagena, chief seaport of Colombia and central shipping point for the oil companies in the country, was without fresh water. Many of the 100,000 inhabitants were using water from unsanitary cisterns for drinking purposes. Vendors hawked the untreated water in the streets at 10 cents a pail.

Civic authorities discovered they lacked both materials and engineers to mend the break. It was estimated it would take the city several months to restore its water supply.

This was the situation when G. T. Armstrong, manager of the Andian Company, went into action on his own initiative. Calling in engineers and pipe line workers of the two companies he quickly organized them into emergency work squads. With the blessings of the mayor, and augmented by some civic employees, the voluntary work squads undertook the job.

Working under a constant threat of, and sometimes interrupted by, fresh landslides the emergency work squads toiled night and day.

It was so much a fight against time for the work squads as it was for the citizens of Cartagena because conditions in the city had ripened for an epidemic. To help avert this the Tropical Oil Company used its trucks to transport water from outlying wells to distribution points in the city.

While the work squads toiled to install a loop of 16-inch pipe line around the break, the city's power plant failed because of lack of water for its boilers.

Hospital services which had already encountered the problem of diminishing supplies of clean dressings and linen were particularly affected by the lack of electricity. To take care of the hospitals the Andian Company rushed in portable power pumps to draw water from cisterns beneath the Company's office building. This was piped to the city's power plant to provide emergency power.

By the fifth day the work squads had bridged the break. The special pipe line, more than 400 feet long, connecting the undamaged sections of the water main, was in place. At five o'clock the following morning the order to release water into the pipes was given.

The first trickle of water to come out of city taps in six days was a signal for rejoicing. Public demonstrations were held in the streets.

"In the name of the City and in my own name I wish to express my deep appreciation for the noble gesture", Mayor Pedro Herrera Gonzalez wrote to Mr. Armstrong. "The people of Cartagena appreciate this action, and I am certain that my expression of true and sincere gratitude is seconded by all the people I represent."

The story of Cartagena's plight and deliverance was carried in all the newspapers of Colombia. Glowing editorials heaped praise upon the Andian and Tropical Oil companies for their work.

"Cartagena has lived through desperate hours," the newspaper El Figaro declared editorially. "This is the occasion to express our eternal gratitude to the North American companies, Andian and Tropical, for their decisive and valuable co-operation...

During Cartagena's hour of need they always responded to her call."

Many letters of appreciation of the voluntary services by the two companies were received, including one from the Archibishop of Cartagena and one bearing 500 signatures of leading citizens.

In a letter to the editor of El Figaro, published in that newspaper, Mr. Armstrong on behalf of the Andian Company and the technical personnel of the emergency work squad said:

"Your words of appreciation are an encouragement to us, and because of our interest in the progress and welfare of Cartagena which has grown during our long sojourn in Colombia, we consider it even a duty to lend any co-operation we are able to during times of public calamity."

Mr. Armstrong, at the same time, paid tribute to the workers from Mamonlo who were members of the emergency squad.

A man works on the pipe line, which ran from the emergency water point of Cartagena, and central shipping point for the oil companies operating in that exotic tropical country.

When landslides crippled the aqueduct of Colombia's chief seaport city the Andian and Tropical companies came to its aid.
R - for Runways

Scientific research by Canadians establishes standards to provide airports with enduring runways.

Canadian research has developed a new method of airport runway design which may save hundreds of thousands of dollars in the construction of a single modern airport.

Few airline passengers pause to think about the construction details of the airports at which they start or complete their flights and yet successful flying depends upon these details. During the war, as military aircraft grew heavier and heavier, the ability of runways to stand up under the increased weights and constant use was of prime importance.

Now, as peacetime airliners follow the same trends of increased weight and use, the performance and condition of the runways affect all air travel.

Accordingly, airport engineers are deeply concerned with the problem: "How thick should an airport runway be?" A Canadian Department of Transport investigation, headed by Dr. Norman W. Mcllroy, has supplied an answer, for which a highly valued United States award has been made.

Dr. Mcllroy and his research associates have developed formulae which engineers, after making a few simple tests, can use to determine the proper thickness for a runway. The method can also be applied to highway construction.

Runways at Canadian airports have only a fraction of the thickness required by some United States design methods. Yet the Canadian Department of Transport engineers know our runways have been carrying thousands of aircraft several times heavier than U.S. designs indicate they can support. They have not been overloading, with no sign of failure.

The best known U.S. design is that developed by the United States Corps of Engineers who built...

The subgrade was made about 12 feet in diameter. When they are finished, the load testing crew will conduct a plate bearing test on the subgrade...
airports all over the world during World War II. They believe their design has been adequately confirmed by their experimental studies.

Against this imposing array of evidence, the Canadian Department of Transport engineers had only the known fact that their thinner runways were able to "take it."

The runways at Dorval airport, near Montreal, are an example. By U.S. Corps of Engineers' design specifications they would be considered inadequate for wheel loads greater than 5,000 pounds. The U.S. Civil Aeronautics Administration places the figure at 7,500 pounds, and the U.S. Public Roads Administration standards give the Dorval runways a limit of 10,000 pounds.

By actual traffic count, however, there have been over 100,000 operations of aircraft with wheel loads of more than 25,000 pounds at Dorval since January 1942. Recently Dorval has handled hundreds of operations by big Constellation aircraft with wheel loads of 40,000 to 45,000 pounds. There have been remarks of runway distress.

Corps of Engineers' standards indicate that Dorval runways should have an overall thickness of about 35 inches of pavement and base course to carry these wheel loads. Yet the Dorval runways are 14 inches in thickness.

Malton airport, near Toronto, has a similar story. By the Corps of Engineers' standards the runways at this airport are not built for aircraft with wheel loads greater than 3,000 pounds. However, during the war Malton was used for test flights by the Lancaster builders built there, and these big bombers had wheel loads of about 35,000 pounds.

In the early spring of 1945 the Department of Transport engineers decided to undertake an investigation of their own to define a method of runway design in keeping with Canadian experience. Because of his wide knowledge of soil mechanics, Dr. McLeod was asked to direct this investigation.

Dr. McLeod was born at Elora, Ont., but grew up in Estevan, Sask. He holds three degrees: Bachelor of Science in Chemical Engineering from the University of Alberta; Master of Science from the University of Saskatchewan, and Doctor of Science in Civil Engineering from the University of Michigan. He was research engineer for the Department of Highways of Saskatchewan from 1930 until he joined Imperial in 1938 as an asphalt technologist. Dr. McLeod's arrangement with the Department of Transport is on a part-time basis, and he also carries on his regular work with Imperial Oil.

Dr. McLeod presented a paper on the more important results of the investigation at the annual meeting of the U.S. Highway Research Board at Washington in December 1946. This paper received the Board's annual award for "outstanding merit" at the 1947 annual meeting. It is the most highly regarded annual award for a paper in the field of highway and airport engineering and this is the first time it has been awarded for a work originating outside the United States.

Dr. McLeod's paper explains that the thickness of a runway will depend on the type of underlying soil, and upon the wheel load. Wet, clay soils require a greater covering thickness than do dry, sandy soils. The soil must be tested to see how much weight it will carry.

The U.S. Corps of Engineers' design is based upon the pressure required to force a three square inch circular piston one-tenth of an inch into the surface of a soil sample that has been completely immersed in water for four days. This is called the California Bearing Ratio test. The Department of Transport's investigation has demonstrated that samples soaked in this manner contained from 40 to 140 per cent. more moisture than was actually found in the soil under Canadian runways that had been paved for several years. This probably explains why the Corps of Engineers' design calls for runway thicknesses that are so greatly in excess of those which Canadian experience has shown to be satisfactory.

In 1945 and 1946, airports at Fort Nelson, Fort St. John, Grande Prairie, Lethbridge, Saskatoon, Regina, Winnipeg, Ottawa, Dorval and Malton were included in the investigation. During 1947, it was continued at Moncton, Calgary and the new airport at Saskatoon.

For a time more than 100 employees were required for the various phases of the field and laboratory testing.

To determine the strength of the pavement, base course and subgrade at each airport, the investigators use a "plate bearing test." From weighted truck trailers as heavy as 150,000 pounds, a hydraulic jack transfers measured loads to a circular steel plate varying from 12 to 42 inches in diameter. The depths of plate settlement under these loads are measured to the nearest 1/100 of an inch by means of settlement gauges.

The equipment required for plate bearing tests is cumbersome and the tests are slow and costly, so Dr. McLeod tried other simpler tests on the subgrade. The cone bearing test was one. By measuring the depths to which a standard cone penetrates into the soil under a given series of weights, the investigators were able to tell something of the soil's strength. The Housel penetrometer gives a similar result by recording the number of blows which must be made by a standard weight dropped a standard distance to force a sharpened pipe six inches into the earth. The investigators also used the California Bearing Ratio test, and in the laboratory soil samples were subjected to soil compaction as the triaxial compression test. Each of these four tests had been correlated with the plate bearing test.

Many hundreds of soil samples were obtained and subjected to routine tests in the engineering laboratories at the University of Alberta under Dean R. E. Hardy, at McGill University under G. A. Leonards and at the University of Toronto under Professor R. F. Legget and R. L. Davies.

The important results of this work up to 1947 were compiled by Dr. McLeod and issued as his first report to the Department of Transport under the title, "Airport Runway Evaluation in Canada."

The report consists of 121 pages of text and an equal number of maps, figures, charts and photographs. From all the field and laboratory work, a design equation and charts of design curves have been worked out. From these, the engineer may determine the runway thickness required for a wide range of aircraft wheel loads and subgrade support. Similar charts have been prepared for highway wheel loads.

These charts indicate that one-third to four-fifths as thick as are recommended by some U.S. standards have been giving satisfactory service in Canada. The resulting difference in construction costs can be very great.

General administration of the Department of Transport's investigation has been under F. C. Jewett, Chief of Wartime Construction, and Theo. Ward, Assistant Chief of Wartime Construction.

Since Mr. Jewett's retirement recently, general administration has been in the charge of Charles Flint, Superintendent of Construction. In their respective districts, the investigation was aided by District Airway Engineers E. F. Cooke, John H. Curzon, Homer P. Keith, W. C. MacDonald, George W. Smith, and A. L. H. Sonnevile, C. L. Perkins, P. J. Peacock, J. P. Walls, D. S. Johnson, and many others helped to obtain and correlate the test data.

All of these men, by their contributions to this seldom-heard-of phase of construction, are adding greatly to its future and to Canada's place in the air age.

With this long handled tool a worker is obtaining samples of soil for the determination of moisture content at depths of from four to ten feet below the surface of the subgrade. 20 IMPERIAL OIL REVIEW 21 APRIL-MAY • 1948
Imperial’s "E & D" Men

The division is responsible for the designs and construction specifications of equipment required for a far-sighted development program. It is also concerned with the maintenance and operating performance of existing equipment which must be kept at peak efficiency to produce quality products, and it conducts a continuous study of the economics of operations.

As the central technical group of the manufacturing department, E & D maintains close contact with the company's plants at Imperial Oil at Halifax, Montreal East, Regina, Regina, Calgary, Edmonton, Ioco near Vancouver and Norman Wells, N.W.T.

This year E & D men are engineering the largest expansion program in the company's history. Part of the program is concerned with the modernization of Montreal East and other refineries for increased capacity and product quality improvement. Another project is the new Edmonton refinery which was made necessary by the discovery of the Leduc oil field.

C. A. Godfrey, I.O.L. process engineer (third from left) inspecto construction work at the new Edmonton refinery site with officials of Imperial Oil and of the contracting company.

70 engineers and specialists work as a team or in groups tackling the problems of new construction, efficient manufacturing methods and the economics of operating modern refineries

The man who heads the E & D division as its manager is George Macpherson, a Royal Naval Air Service veteran of World War I. He is a University of Toronto graduate who joined Imperial as a draughtsman in 1925. In 1935 he was made assistant chief engineer and eight years later, when Tom Montgomery retired, he succeeded him as chief engineer.

The assistant manager is Dwight S. Simmons. A graduate of Queen's University, he joined Imperial in 1932.

The manager and his assistant co-ordinate and direct the work of the five technical groups within the division. These include the process engineering, construction engineering, and mechanical engineering groups which prepare plans for new equipment or for the adaptation of equipment and also supervise construction in progress. The production control group is especially concerned with the efficiency of day-by-day operations. The process development group assists in the development of new processes that will improve operations.

When a "cut-cracker" or new refinery must be built, George L. Macpherson, manager of the Engineering and Development Division, puts his staff of 70 engineers and specialists to work...
The new catalytic cracking unit for Montreal East refinery will increase the production of high value gasoline. Here a fractionating tower is being installed for the "cat cracker" catalytic cracking, one of the many processes developed by this co-operative effort.

To the uninitiated the work of the E & D Division is unbelievably complicated. The construction and operation of a modern refinery unit is so intricate that no one man can master all phases. As a result one engineer will specialize in cracking (breaking down complexed oil molecules into simpler ones). Another may concentrate on polymerization (build- ing up simple molecules into complicated ones).

Their work often begins with the recommendation that new equipment is needed, and they prepare plans from which the costs of the new project may be estimated. For instance, when the need arises to increase the output of a product such as high octane gasoline, the problem of planning the necessary equipment is the task of the E & D men.

In the refinery the production control engineer is responsible for the technical phases of processing from the time the oil comes into the plant until it is pumped into storage tanks as finished products. He is also responsible for setting up standard operations whose yields and costs are the most economically desirable. His records, or "flow sheets," show the percentage of each product that should be obtained from a unit.

Metals and other types of refinery recording instruments supply the refinery production control engineer with data from which he prepares daily reports on operating conditions for the guidance of the operating people.

The production control group co-ordinates the activities of the Company's eight refineries and provides management with accurate information on these activities. The group charged with these responsibilities is headed now by G. R. McMillin, formerly assistant superintendent of Imperial's refinery near Halifax. Mr. McMillin succeeds E. Keith Lewis who has been promoted to superintendent of Imperial's refinery at Montreal.

As the petroleum industry is a highly competitive business, E & D men are constantly engaged in developing equipment for new processes and modifying existing equipment to produce better quality or to increase operating efficiency. In the inspection laboratories of each refinery the Company's products must be tested continuously to ensure that they meet rigid standards of quality.

The work of these refinery laboratories is co-ordinated by the process development group headed by Leonard F. Whitfield, supervisor, a graduate of the University of London (Eng.) who joined Imperial in 1927. This group checks testing techniques and is also responsible for planning new laboratories.

At present the group is directing the erection and equipping of new labs at Montreal East and Edmonton. Also, this group acts in liaison with the research laboratories under Dr. Stratford and the technical service department under Gordon McIntyre, in applying new developments in these fields to the work of the manufacturing department.

Back of many of these projects is the work of the mechanical engineers who deal with materials and specifications. They design and produce control systems and mechanical parts and decide what auxiliary equipment a plant will need. They are also overseers of the "utilities" used by the refineries—steam, electricity and water, which are important items of operating costs.

The draughting room also comes under the mechanical engineering group, headed by Andrew A. Russell, supervisor. He is a native of Carlisle, England, who joined the Company in 1928. In the draughting room ideas are put down on paper as drawings, tracings and blueprints. After verification by any member of the groups in the E & D Division the ideas may be translated into the concrete, brick and steel of a production unit.
Bringing Down the Towers

Here is the refinery in its Whitehorse location. One of the heavy trucks used in transporting sections may be seen on the road.

Moving the Whitehorse refinery towers to Edmonton was an engineering feat carried out by skilled workmen in short-lived northern light and biting temperatures.

It's one thing to pull down a refinery and let it go at that. But it's an entirely different problem to dismantle one and then set it up again to be in working order.

This was the problem which has been involved in transferring the Whitehorse refinery purchased by Imperial Oil for re-erection in Edmonton.

A difficult part of the dismantling job was taking down the 80 to 150 foot towers, the tallest weighing in the neighborhood of 150 tons. The towers had to come down intact. They were hauled in heavy special trucks over the Alaska Highway 1,000 miles to Dawson Creek, thence by rail to Edmonton.

Complicating the task were days when strong winds made it impossible for riggers to ascend to their lofty places of work on the towers. Added to this were the limited hours of daylight in the Yukon which forced the men to work in northern twilight and with the aid of lights.

(Continued on page 28)

Riggers climbed aloft to start work on the giant tower at daybreak. But hours of winter sunshine in the Yukon are short and daybreak was 10:30 a.m. when this photograph was taken.
Bringing Down (Continued)

The project when completed will cost an estimated $7,300,000, including the purchase price of $1,000,000. Imperial decided upon this unusual undertaking as a means of saving 18 months in getting a refinery in operation at Edmonton to process the flow of crude oil from the Company’s wells in the Leduc field.

These towers that once dominated the Whitehorus sky line were transported down the Athabasca Highway on trailers and dollies behind heavy track. A tractor helped on grades.

At last the tower has been lowered. Timbers and rollers at the butt will help to complete the rest of the move from the base.

Personalities in the News

Clarence M. Moore Retires at Calgary

Clarence M. Moore, who had been in charge of operations at Calgary refinery for 23 years, retired recently as general superintendent. A veteran oilman and holder of the Company’s 40-year service button, Mr. Moore began his career with Imperial at Sarnia. In 1916 he supervised construction and operations of the Company’s Regina refinery. Six years later, when construction of the Calgary refinery was begun, he went there as superintendent and afterwards was appointed general superintendent.

J. J. Hanna Now Calgary Superintendent

J. J. ( Jeff) Hanna has been appointed superintendent of Calgary refinery, succeeding C. M. Moore. Born in Toronto and educated there and in Calgary, Mr. Hanna is an engineering graduate of the University of Toronto. He served overseas in World War I and worked for a time on construction engineering in Alberta before he joined Imperial when Calgary refinery was being built in 1922. He became assistant superintendent in 1925 and received his new appointment early this year.

A. G. Stewart Succeds J. J. Hanna

A. G. Stewart, former process supervisor at Calgary refinery, has been appointed assistant superintendent of the refinery. Mr. Stewart joined Imperial Oil in 1930, after graduating from the University of Alberta. After six years in the Calgary laboratory, he was transferred to the marketing department at Medicine Hat. When he returned to Calgary refinery he spent several years in operations at the combination unit. In 1943 he was appointed process supervisor and also worked with production control and personnel matters.

E. M. Mackenzie With Company 40 Years

Fred M. Mackenzie, assistant office manager in the stock department, Toronto, recently won his 40-year service button. He was born in Port Burwell, Ont. and graduated in the Aylmer public and high schools. In Jan., 1898, he joined Imperial’s manufacturing department at Sarnia as a second clerk. Later he was transferred to Toronto, and in 1912 went to Hamilton as pay-roll clerk of Western Ontario Division. He returned to Toronto in May, 1918, and three years later was transferred to the stock department. He received his present appointment in September, 1943. Mr. Mackenzie is fond of all sports, particularly boating, fishing, hunting and bicycling.

E. W. Mackereth Receives 40 Year Button

E. W. Mackereth, agent in charge of operations at Fort William has completed 49 years with Imperial Oil, Born in Liverpool, England, Mr. Mackereth came to Canada in 1907 and joined Imperial at Fort William. He was promoted to foreman of the refinery aiding department in 1911, and two years later was transferred to the general office. He received his present appointment in 1941 following the retirement of W. J. Harris.

Mr. Mackereth served in the C.E.F. during World War I. He is a member and past president of the Fort William Rotary Club. Photography and gardening are his main hobbies.
fully check the gases encountered as the hole goes deeper because they help to tell the chances of finding oil. In the refinery analysis is a check on the operating efficiency of various units and also a safety measure.

It is in petroleum research, however, that gas analysis proves of greatest value. The gases produced in refining operations were formerly used as fuel in the furnaces. But now research has shown that they possess great value as raw materials from which chemists can make things ranging from antifreeze to rubber or plastics. These new uses for materials formerly considered suitable only for fuels have been made possible by science.

Analysis is the step which a chemist takes to find out what chemical elements and how much of each are present in some unknown substance.

The gas analyst in the refinery is concerned chiefly with the gases produced when crude oil is distilled or treated by a cracking process, (a method of breaking up complex petroleum substances into simpler ones by heat and, usually, pressure). The more lighter products thus obtained are called "light ends." Of the various hydrocarbons which go to make up these light ends, eleven - methane, ethane, ethylene, propane, propylene, isobutane, normal butane, iso-butylene, butadiene and butylene 1 and 2 - are gases under ordinary conditions.

At intervals during the production run samples of the light ends produced are drawn off into steel sample "bombes" and presented to the analyst. The question then is to determine with speed and accuracy just what proportions of the various hydrocarbons are present.

The sample bomb contains a mixture of gases. The first step in analysis in the laboratory is to divide the mixture into separate parts on the basis of their boiling points. These parts are called fractions or "cuts" and may consist of one or more gases. The cuts are then further analyzed to see what compounds they contain.

The "Pod" apparatus is used to separate the sample into various cuts by distillation. To do this the mixture of gases is transferred to a glass flask in the "Pod" and cooled with liquid nitrogen at 230°F below zero. At this low temperature the hydrocarbons are condensed to liquids and can be separated by distillation.

A small built-in electric heater warms up the mixture just enough to boil off the first fraction, methane, which is collected as a gas in a special flask. The other fractions are separated according to their various boiling points and stored in separate flasks.

The "Pod" is an exceedingly complex machine. Automatic devices control the temperature and flow within close limits to ensure maximum separation. A continuous record is made on paper to show how much of each cut has been collected. If a flask needs changing or if anything goes wrong the machine rings bells, flashes lights and shuts itself off.

"Pod" analyses are expensive because it takes a skilled operator about eight hours to do one and they do not completely separate all the possible components. Therefore they are supplemented by other methods.

Further testing is often carried out in the Orest apparatus. It works on the principle that some chemicals react with only certain of the hydrocarbon gases. The volume of a mixture of gases is measured before and after treatment with a chemical. If the chemical reacts with only, say, isobutylene, then the difference in volume represents the amount of isobutylene in the mixture.

The Orest apparatus is compact and gives a speedy method of analyzing a mixture. It consists of a series of glass flasks containing various chemicals. A measured volume of the gas mixture is passed through each of the flasks in turn. The volume is measured before and after each chemical treatment, and the measurements indicate how much of each gas was in the original sample.

The Imperial Oil laboratories at Sarnia now are equipped with both infra-red and ultra-violet spectrophotometers of the latest design. These two instruments operate on the same general principle, but at opposite ends of the spectrum.

To understand something of the operations of these two devices it will be helpful to remember that

During a production run at a refinery, samples of gaseous products are drawn off at regular intervals in steel gas "bombes" like the one shown here. Laboratory analysis will tell what quantity and variety of gases are in the "bombes."
effect of light shining through a prism and also through stained glass. White light from the sun or an electric lamp actually is composed of all colors of the rainbow mixed together. Because each color has its own wavelength, white light shining through a prism splits up into the individual colors which spread out to form the rainbow pattern known as the spectrum.

The beautiful colors of a stained glass window are possible because the dyes in the different pieces of glass have the ability to absorb certain color wavelengths. For instance, a piece of glass that appears red when light shines through it does so because the dye in the glass absorbs nearly all the colors of white light except red.

The spectrophotometers use something of this principle in gas analysis. Many substances have the ability to screen out certain light wavelengths and allow others to pass. As a result, when light shines through a substance and then through a prism to form a spectrum, there is a visible effect on certain areas of the spectrum because of the wavelengths that have been absorbed by the substance. This produces a pattern which differs with each element, just as fingerprints differ for each individual human. By comparing the patterns of an unidentified substance with those of various known substances, the analyst can arrive at exact identification.

All spectrophotometers are simple optical devices for measuring how much of what wave lengths has been absorbed by the sample under test. From these measurements, the proportion of butane, for instance, in a mixture of gases can be determined. The wave lengths corresponding to visible light can be used only for gases and liquids which have some color. Since hydrocarbons are colorless, the spectrophotometers in use in refinery laboratories make use of radiation in either the ultra-violet or the infra-red wavelengths.

Infrared and ultra-violet spectrophotometers consist in essence of a source of ultra-violet or infra-red rays, a chamber for holding the gas sample in the path of radiation, and an optical device for determining the wave length of the radiation absorbed by the gas. The gases contained in the sample are indicated by the amount and type of radiation absorbed.

Gas analysis has always been important in the petroleum industry for other reasons than those mentioned above. For instance, it contributes largely to efficiency and safety in operations. Imperial refineries are constantly testing the atmosphere of tanks and working areas for the presence of dangerous gases. By analysis with portable electric equipment, it can be determined whether or not air is safe to work in or breathe. To protect the workmen, these instruments are used to test all refinery equipment before it is inspected or repaired.

For efficient refinery operation gas analysis is widely used to provide the correct firing conditions in the many furnaces. Such analysis provides a good measure of a processing unit's efficiency. At Sarnia this method of production control is considered so important that several men are employed full time in routine gas analysis and adjustment of furnaces.

The gas analyst also plays a role in the determination of quantities. In order to measure the amount of each gas in a mixture, the composition must be known. At Sarnia the gases piped to the Polymer plant need careful analysis to meet the requirements for the production of synthetic rubber and plastics.

Safety and efficiency are important, but the most exciting new field for gas analysis is its use in connection with the new raw materials for the chemical, plastic and protective coating industries. Gaseous hydrocarbons are an almost infinitely versatile raw material, and can be used to make a fantastic array of products. Many things, from local anaesthetics to insecticides, from paint to dynamite, and from face creams to movie film can be made from the gases given off when crude petroleum is refined. The unsaturated hydrocarbons such as ethylene, propylene and the butyl esters are the most important building blocks for synthetic chemicals, and from various combinations of these elements it is possible to make almost any organic chemical.

Whether or not such chemicals will in time be made from petroleum is largely a matter of economics. If a need for a certain chemical develops in an area where the required petroleum gas is available but the natural chemical is not, then the mass production of the chemical as a synthetic might well be practical as a commercial undertaking.

As a result of the wartime need for ethylene for the synthetic rubber program the extraction of this gas from the light ends is being done on a commercial scale at the Polymer plant, and the surplus over Polymer's requirements is sold to nearby Dow Chemical to make a permanent type of antiknock. Chemists have worked out a process for separating propylene from the refinery gases and by the use of benzene and a catalyst to make cumene. This is an excellent blending stock for making aviation gasoline. This process is being pushed because gasoline of adequate quality can be made by less expensive methods.

In making these and other new petroleum products possible gas analysis has assumed a crucial importance. Imperial Oil Chemists believe that gases will become increasingly vital in Canadian industry. As uses for petroleum gases increase in number science will keep pace, developing new techniques and even more versatile instruments.
These Printed Words

The story of the mechanical production of this magazine and the part played by petroleum products in modern printing processes

If the text for this story had been set in type by Johannes Gutenberg, the father of modern printing methods, in his workshop in Germany 500 years ago it would have taken not less than eight days. Today the time for a page of the Imperial Oil Review can be set and cast in metal in less than one hour.

This illustration of the improvement in the speed of printing is typical of the great changes that have taken place over the years in the production of the printed word. Because of them, modern newspapers, magazines, books and other publications are possible.

It has been said that the art of printing turned the darkness of the Middle Ages into light, preserving the achievements of the past and multiplying the effects of progress. Printing remains man's most valuable means of communication and the source of widespread education and knowledge.

This article is about the words you are reading on this page—how they were printed on paper to convey their meaning to you.

The first step in the production of a magazine like the Review is to prepare manuscripts of the various articles and to assemble pictures and drawings required for illustrations.

After the author's draft of a story has been edited, checked for accuracy and approved for publication, a typewritten copy of the revised manuscript is sent to the printer. Here, the "copy"—as the manuscript is known—is marked by the printer for the size and kind of type that will be used. The copy then goes to the composing room to be set and cast into metal characters and assembled, with engravings of the illustrations, as a page of type.

Comparatively little type is set by hand these days and at Saturday Night Press, where the Review has been printed for the past 31 years, type for the magazine is set on a machine called a Monotype. As the name implies, each letter is cast individually. When the Monotype operator, operating a keyboard somewhat like that of a typewriter, strikes the keys, holes are punched in a paper tape which is wound in a roll. The punched roll is then sent to the casting machine.

This machine, operating on the same principle as a piano, plays the roll by compressed air and casts each individual character from molten metal by means of a mold or mould. As the metal cools the characters are fed out of the coater and lined up in the same order as they were originally punched into the paper.

In newspaper composing rooms, where speed in getting the copy into type is most important, the type is not cast as individual letters but in one line of type of the required column width. The machine used is a Linotype and the cast type is fed from the machine in the form of solid metal "shoes".

Oil products are used in almost every printing process. The Imperial Oil Review is being printed on this flat bed cylinder press

After an article is completed, copies of the author's text would be typed to be sent to the printing plant. The typesetters, using Linotype machines, would produce the text to be typeset.
brief description of this operation appear on the following page.

Meanwhile, ink is put in the ink fountain and the rollers, which transfer the thin film of ink to the type and engravings, are placed in position.

Once the "make-ready" has been completed the press starts its run. As the freshly-printed sheets roll off the press, each is sprayed with an invisible coating of a special petroleum wax which helps to prevent "offsetting." This is a term used by pressmen when ink from one sheet is transferred or offset to the back of the next sheet as it comes off the press. Until a few years ago this was an ever-present problem but now, with modern, fast-drying inks and wax spraying, the danger of offsetting has been greatly reduced.

When the printed press sheets leave the pressroom they go to the bindery to be folded by machine to page size. The folded sheets, in 16-page and 8-page sections, are then collated and assembled as a magazine. The covers, which require heavier stock than the inside pages, are printed separately. The cover and assembled sections are stitched together by thin copper wire staples on a machine called a gang stitcher.

After the edges have been trimmed the Reviews are sent to Imperial Oil's mailing department where the magazine is inserted in previously stamped and address envelopes ready for mailing to thousands of readers in Canada, Newfoundland, United States and South America.

Although printing existed for hundreds of years before the discovery of petroleum, petroleum contributed greatly to the development of modern, high-speed printing as we now know it. Today petroleum is an essential in all printing plants and oil products have many specialized uses in many different printing processes. In addition to providing oils and greases to keep high-speed presses and bindery machinery operating smoothly and efficiently, the petroleum industry provides oils for printing inks, and waxes for quick drying of the freshly-printed sheets.

Solvents, another product of petroleum refining, find use as cleaning fluids. Solvents are needed to remove ink from type and from the rollers which spread the ink across the surface of the metal words and illustrations locked on the bed of the press. Even the typewriter ribbon and carbon paper used by the typist to type the manuscript of this article, contain petroleum.

Petroleum plays its most important role in the manufacture of the many types of ink used in modern printing. Until recent years printing inks possessed the major disadvantage that they created an uncertainty about drying time. This seriously slowed production and increased printing costs. To overcome this problem the ink-makers and the oil industry cooperated in the development of fast-drying inks. Without these inks many of the mechanical improvements in printing processes in recent years would not be possible.

Newspapers must be printed quickly. High-speed rotary presses are employed which print on both sides of a fast-moving ribbon of paper and can deliver a complete newspaper every 1 1/2 seconds. Fast-drying newspaper inks containing petroleum practically revolutionized newspaper printing and permit today's high-speed production.

Another place where the petroleum chemist was able to come to the aid of the ink-maker was in the manufacture of inks that would dry quickly although exposed to water and oil—one of the peculiarities of the lithographic printing process. The same may be said for inks developed especially for retogravure process which now travel at a speed of 1,400 feet of paper a minute—more than 23 feet a second!

Today inks present a wide color range but ink-makers of early times were limited in the colors they could produce. Their pigments were obtained chiefly from the sap of trees and from sepias, the brownish-black liquid secured from the cuttlefish.

Research by ink makers and the oil industry has developed fast-drying inks, making possible high-speed production of magazines and newspapers. Clarence Weinert in seen here smoothing out the ink which he has placed in the fountain. Petroleum products have helped improve the quality of printing inks. In making inks, the ingredients are placed in a mixer (left). When kneaded, the batch is transferred to an ink mill (right) where spinning rollers grind pigment particles.
widely used in the printing of magazines and newspapers, is mainly of petroleum origin.

Inks must flow smoothly on the paper and for this and other reasons ink manufacturers pay special attention to what they term the "vehicle" ingredients. Vehicles are made from vegetable, fish or mineral oils. Mineral oils are used in practically all inks that dry by absorption into the paper. The use of petroleum derivative vehicles in new inks improved their quality and reduced the problem of smudging and rubbing while going through the presses at high speed.

Petroleum not only enters into the production of the inks, but it is also required in the manufacture of synthetic resins used on certain types of presses. These resins help to apply the ink evenly to the type and their chief ingredients are glicerin which may be a petroleum derivative and glue.

Printing is sometimes called "the art that preserves the arts". As man continues to push back frontiers in the fields of arts and sciences, each new addition to the world's fund of knowledge is recorded by printing. Printing makes readily available the learning of centuries to the students of today. Our meteoric advances of the last few decades, with each new generation adding to the accumulated knowledge, of the past, would scarcely have been possible without printing.

A dog team is only one of many modes of transport which Len Love uses. Others include aircraft, "snowbirds", tractors and boats.

**Len Love, "Lube" Consultant**

He solves the special lubrication problems of marine and diesel engines in many parts of Canada and Newfoundland.

Leonard V. Love's chair in Imperial's general sales department at Toronto is often empty, and telephone calls to his office frequently receive the response: "I'm sorry, Mr. Love is out of the city".

The reason is that Len Love is one of the most travelled men in the Company and is almost constantly on the move throughout his territory—which is all of Canada and Newfoundland.

He is in charge of "marine and diesel" operations in the lubrication sales department. His job is to survey engines and recommend the fuels and lubricants which will make their operation most economical for the owners.

His duties entail dealing with executives of steamship companies and shipyards in recommending the various lubricants used by operating ships and in new ship construction. Troubles which arise with equipment already in use are also his problem.

Diesel engines are his specialty, whether they are powering mine equipment, heavy plywood trucks, or an ocean liner. His activities have eliminated thousands of provoking, worrisome problems and have saved customers thousands of dollars through
He has surveyed most mines in the Northwest Territories—some of them annually—and he has visited mines, paper mills, industrial plants, and construction firms in Newfoundland, in addition to his marine survey activities.

In the Northwest Territories Mr. Love has visited the Eldorado mine at Great Bear Lake almost every year since 1928. His first trip in was by air, and the plane was forced down by carburetor trouble at Lac La Biche. Luck was with him, however, and the flight was resumed the next day.

This job is typical of his activities. The diesels at Eldorado had to operate at temperatures from 60 degrees below zero to 70 above, and extensive mechanical changes were necessary to meet these conditions. Mr. Love evolved a new method of handling and filtering fuel oil and changed the water cooling so that the engines had a closed circulating system instead of drawing cold water from Great Bear Lake. These changes saved the mine operators thousands of dollars annually.

One of Mr. Love's biggest jobs was at the United States base at Angerita, Newfoundland, in 1942. During February and March he supervised the delivery of diesel from dock to operating base and looked after their fueling and lubrication. In one day he supervised the starting of 68 diesel engines.

Another Newfoundland task was a survey of the bush, road, and marine equipment of Bowater's, Newfoundland's big pulp and paper company. The company was operating diesel-powered trucks to haul pulpwood from Hampden to Aldery Pond. The pulpwood was bundled into five-ton lots and nine bundles comprised a load. Operating conditions were severe, but Mr. Love recommended Imperial heavy-duty lubricant which stood up under the punishment.

His duties include arranging with engine builders in Canada and the United States for tests of Imperial products in the engines they build. He follows these tests of fuel and lubricating oils and greases through all stages from test runs to final approval.

At present Mr. Love is engaged in a lubrication survey of the engines of all new ships built in Canadian shipyards for the French, Chinese and Portuguese governments. Some 90 ocean-going vessels are included in this survey, as well as smaller craft.

Tasks like these, along with his regular trips to Newfoundland and the Northwest Territories, will keep Len Love on the move during 1948 as in past years. His thousands of miles of travel mean increased efficiency and lower operating costs for owners of mining, marine, transport, and diesel equipment.

To keep diesels operating efficiently, compression and firing pressure readings are taken regularly. Here Mr. Love makes a test on a 95-horsepower twin diesel which drives a generator...
These towers are actuators, important part of a scrubbing plant which purifies natural gas in Turner Valley. The loop in the pipe is a safety device to absorb expansion stresses in the pipe.