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IN THIS ISSUE: Page
Leduc Looks Good 2
Saline Solen— 7
He Aids Agriculture 10
1947 Fellowships Awarded 13
The Rock Readers 14
"Ex" Re-opens 20
Safety Is No Accident 22
Founding for Petroleum 27
Cash for Ideas 30
Personalities in the News 32
C.I.C. Convention 32

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LAST MONTH, as Canada observed its national anniversary on July 1st, newspapers reviewed the achievements of 80 years of Dominion history. Canada, they said, is a nation "young in time but old in experience and mature in industrial progress." Since Confederation she has grown to span the continent; her agriculture and industry have enriched the world; her sons and daughters have pioneered invention in many fields; and she has been an indispensable source of men, money and munitions in two world wars.

The oil industry of North America has been a basic factor in our national progress. It has afforded to the individual a strength far in excess of the strength of ten; by multiplying man's productive power it has increased the national wealth, fortified liberty and independence, and pushed back the frontiers of space and thought.

In its development the industry has given employment to ever-increasing thousands, and has taken leadership in the establishment of sound relations between workers and management. Good wages, reasonable hours, security plans such as pensions and death benefits and low cost insurance; holidays with pay for all classes of workers; these and other enlightened products of understanding and vision and mutual confidence have made the petroleum industry's labor-management relations notable.

Keen competition has stimulated technological progress and afforded to the consumer consistently improved quality at almost steadily reduced prices.

Now the industry is well into its great post-war program of plant expansion, replacement and rehabilitation, and although hampered by shortages of materials it is making substantial progress; and out in Alberta a new oil field has been discovered after many years of searching which promises to make another important contribution to the national progress and well-being.

The oil industry today is supplying an unprecedented demand for its products. This has given rise in some quarters to fears that acute shortages may develop; that the resources of crude petroleum and other raw materials are seriously overtaxed. True, there is difficulty in expanding facilities rapidly enough to meet rising consumer demands, but there is no basic shortage of petroleum and we can confidently expect that the problems of today will be faced and solved because they are neither more difficult nor intricate than the problems of the past when considered in the light of conditions that then prevailed.
Gone is the towering derrick with its long, pendant stands of drill pipe or casing. The clang and rattle of machinery is stilled. The pillar of fire by night or of smoke by day, which marked the blowing in of the well, is in retrospect, The tool pushers and their crews have emulated the Arabs and stolen away, more or less silently.

All that remains to be seen is a pipe sticking up from the ground, decorated with an assortment of valves and gauges; a tall metal cylinder in which the oil and gas take leave of each other after their million years of close association; a few white painted tanks holding the precious crude till it is whisked off to the refinery; a slender, wavering finger of burning gas from the flame which even the grazing herds placidly ignore.

There are now four such installations in the Leduc oil field. Note that we come boldly into the open and use the term "oil field"; for even the traditionally conservative, the notoriously skeptical and the inherently pessimistic are agreed that, once you have drilled four wells and found production in all of them, the exploratory phase is over and you are in the stage of development.

The Leduc oil field could not have blossomed in the fertile farm lands south of Edmonton at a more acceptable time. Turner Valley, which has been Canada's major source of crude supply since 1918, is feeling the effects of its war effort and has declined from a peak of 9,701,719 barrels in 1942 to 5,937,362 barrels last year, a loss which even the steadily increasing output from the fields on the plains can do little to repair.

Total production of crude in Alberta during 1948 was 6,839,921 barrels; crude oil receipts at Alberta refineries, for the same year, were 6,276,646 barrels, leaving a very slim margin to alleviate the needs of the sister provinces.

Meanwhile consumption continued to grow, last year's requirements of fuel for Manitoba, Saskatchewan and Alberta totalling 14,270,931 barrels, of which 9,626,938 barrels were aviation and motor fuels and 4,643,993 barrels were in the heavier fuel category.

To help cope with this demand prairie refineries, which according to latest government statistics have a daily capacity of around 40,000 barrels, could only obtain approximately half of their requirements, if going at full blast, from domestic produc-

From far and near, by every means of travel available, young and old came to watch the drillers. Pillars of fire and smoke guided these spectators to Leduc to see the wells came in.

Leduc No. 3 (Left) and No. 2 blew in on the same day, May 21 last. This birth of twin wells is unparalleled in Alberta oil annals.
tion, the balance having to be imported from fields as far distant as East Texas and Louisiana, with the heavy transportation costs reflected in the price of finished products.

Leduc is at least a partial answer to the problem of supply and demand even as it stands; time and energy will determine the extent of its contribution. Almost as difficult and tortuous as the roads which lead to some of its drilling locations is the road which Imperial Oil has travelled before attaining this measure of success. It is a road which has traversed the prairies of Alberta and Saskatchewan; wound through the foothills by Coalspur, Stobberg and Musker; followed the rivers, the portages and the lakes to far off Norman.

To follow this path of exploration has called for an expenditure of $16,500,000 since 1939, when the impact of war emphasized the need for oil.

Imperial Oil geologists started along this road when it was merely a trail some 25 years ago; geophysicists have followed its wanderings with their gravimeters and their seismographs; core drillers have tested its foundations and, irregularly spaced along the entire length, are the dismantled derricks and the abandoned locations which tell the heart-breaking story of non-success.

Imperial Oil reached Leduc the hard way!

True there have been oases along the route, if one is prepared to visualize the frozen fastness of Norman Wells as an oasis. As a result of war's alarms, development at Norman Wells has accounted for the bulk of Canada's present proven oil reserves; around 30 million barrels in the ground for future needs. This is meanwhile being doled out as required to satisfy the mining industry and transportation in the far north, but efforts to secure production over a wider area have proved disappointing in spite of 78,000 feet of wildcard drilling.

Turner Valley, with its natural beauty and with the scenic grandeur of the Rockies as a background, might more fittingly claim the title of an oasis, and its prolific flood of crude over those past 10 years has meant as much to the oil industry in Canada as the cooling springs of a desert oasis mean to the thirsty Arab and his camel.

Imperial Oil has done on little to develop the Val- ley. Royalite No. 4 well in 1924 set the stage for Canada's greatest oil field so far and, even although its heyday may be over, Imperial and its associated companies have spent $15,000,000 on development since 1939.

Then, Kinsella is a bright spot on the horizon (al- though possibly a far horizon) for if the day ever comes when crude oil is so scarce as to justify expensive plants for converting natural gas into synthetic crude, the proven gas reserves of Kinsella may come into their own.

Leduc, however, may help to postpone that day! When the short-stop in a baseball game makes a snappy throw to first to retire the runner by a step, he gets an "assist". In much the same way a well drilled at Princess, out on the plains, might be credit- ed with an assist on the Leduc discovery, for there the California Standard found oil in the Devonian of Alberta.

Geologists knew, of course, that rocks of Devonian age underlay the younger sediments over the prairies. They had speculated on the possibility that the Devonian limestones might be commercially oil-bearing. Princess set their doubts at rest.

Going into a bubble, Imperial Oil geologists selected a number of areas where deductive reasoning seemed to indicate that the attitude of this deeply buried strata might be favorable for oil accumu- lation, but the final analysis had to be left to the geophysicist.

Seismic surveys were undertaken and the delicate mechanism of the recording instruments caught an echo from the Devonian under Leduc, indicating that here was a deviation from the natural order, a seismic "anomaly".

The rest is history! Leduc No. 1, as a wildcat test, was carefully followed down every foot of the way, its cores barring the sub-surface secrets to the trained eyes of the geologists. At 5,029 feet saturated cores were recovered from a porous horizon in the Devonian lime and drilling continued to 5,966 feet when casing was set on top of the producing horizon and the well "blow in" on February 13th, 1947.

Imperial's second test got disappointing results in this upper porous zone; although oil and gas were present the formation was much more tightly compacted than in No. 1. Drilling continued until a second porous horizon was encountered from 5,375 to 5,415 feet, with salt water showing at the extreme depth. This was promptly plugged off with cement and further operations were conducted with extreme care until it was ascertained that the water shut-off was effective.

A light wash was necessary to clear the plugged formation before the well became active, but it gave a very satisfactory exhibition of its potentiality at 6:30 a.m. on Wednesday, May 21st.

At No. 3 the stratum which produced in the discovery well was found to be slightly more porous.

Took theer Dr. Lionel Leson (at right) and Assistant Bill Ream supervised drilling at Leduc No. 2 and No. 3. When they hit in a well, drillers are the happiest men in the business.
than in No. 2, but less attractive than in No. 1. At 5,176 feet drill stem tests developed a flow of natural gas running to two and a half million cubic feet per day and from that depth to 5,313 feet porosity was good.

Encouraging showings of oil were met with in the final 16 feet of drilling and the well was tested at that horizon. After swabbing had removed all but around 2,000 feet of mud from the hole the well was shut in to build up pressure. At 5:29 on the afternoon of May 23rd it showed its first signs of activity and within an hour had cleared itself and was flowing by heads.

It might be dangerous to take in too much territory but certainly never in Alberta, nor ever perhaps in a much more extended sphere, have two exploratory wells in a wildcat field come into production on the same day.

These three wells were drilled with Imperial rigs under Imperial personnel; Leduc No. 4 was drilled for the Company by "Drilling Contractors", a firm well known in both the proven and prospective fields in Alberta.

The lower porous zone was encountered at 5,335 feet and penetrated for 17 feet. Porosity here appeared to be greater than at any of the other locations and the well made an auspicious debut on June 7th.

All of these wells are producing steadily but "under wraps" to borrow a phrase from the race course, because the oil must be carried by tank wagon to Leduc for transshipment by rail. A new industry has invaded the district for truck owners are having their vehicles equipped, by Imperial Oil, with the necessary tanks and are haul ing merrily from dawn to dusk.

Hence we now speak, with due caution, of the "Leduc Oil Field".

The matter, however, cannot be allowed to rest there. Producing wells are not any too particular as to where their production is coming from and there are such things as mineral rights. Off-set wells must be drilled to protect acreage adjoining a producer and ensure that its quota of oil is not purloined. Development goes on apace in the wake of discovery.

Then there is the possibility of expansion. This, seismically, may be under Leduc may have its counterpart in other areas of hidden Devonian strata. So drilling is undertaken at Looma, roughly 20 miles east of the Leduc producers. A location has been selected near Morinville, 18 miles north of Edmonton.

Southwest of Leduc, in the Pigeon Lake area, Imperial-Battle Lake No. 1 is preparing for a deep test. Sixty-five miles northwest of Edmonton, Paddle River No. 1 makes its bid for fame.

Any of these ventures may be successful. Leduc may be duplicated any day.

The importance of Leduc to the oil industry, and to industry and agriculture in the prairie provinces, cannot be minimized, nor should it be exaggerated. On the basis of last year's figures the west could absorb the output of approximately 100 new wells, each producing 200 barrels per day. Even if Leduc and fields yet to be discovered had that number of proven locations ready for drilling there would be obstacles: rotary drilling rigs and experienced drilling crews are not too readily available and, more important, is the difficulty of procuring the necessary steel casing, which is already causing Alberta operators a severe headache.

While Leduc oil field is the cause of an upheaval in the farming community into which it has so suddenly and surprisingly emerged; while it is the main subject of gossip, speculation and rumour in the shoe-shine parlors, barbershops and hotel lobbies in Edmonton; while it has been and probably will continue to be the subject of newspaper headlines and comment, it has a deeper and wider significance.

This was emphasized by Mr. H. H. Hewetson at the Company's annual meeting, when he said: "I need not comment on how good an enlarged production of oil in Canada would be for all segments of the national economy. It would mean an addition to the national income and, in the course of time, with production at a sufficient level, it would mean also a substantial reduction in the cost of petroleum products to consumers on the prairies. This, of course, would also be a very important contribution to the national well-being because it would eventually lower the cost of production for our great agricultural industry."

Leduc, therefore, is a milestone and a stepping stone, but for Imperial Oil and the many companies who are wildcarding in the west, there is still a "Stone Unturned", because Canada is athirst for oil.

"If you can fill it, we can move it", is the truckers' motto to an oil beam. This big storage tank is on its way from No. 1. Dealers keep on the move and few in parlaidas or trailers.

FOR MORE than 20 years cottagers in Ontario's Muskoka lakes have had their oil supplies brought to them by water. Technically the best which makes these deliveries is known as a marketing lighter, but summer residents from Bala to Rosseau call the "Muskokalite" their floating service station.

The "Muskokalite" was built to serve cottagers and dealers in the Muskoka area beyond the reach of the tank trucks. Sixty-five feet in length, with a 15-foot beam, she carries everything the cottagers need to power and lubricate their boats, as well as assorted needs such as friction tape, flashlight batteries, and sun goggles. Her main cargo, of course, is gasoline, and her tanks hold 1,500,000 gallons—more than the average tank truck.

Enroute to Lake Rosseau the "Muskokalite" passes the Fort Centre dock. The drum in the bow hold diesel and lubricating oils.
SKIPPER of the "Muskokalite" is Imperial Oil Agent Alvin Croucher, who has been sailing the Muskoka lakes all his active life. Working on his father's steam tug, the "Niaka", he learned to know Muskoka's waters like the palm of his hand. The experience he gained was invaluable—for anyone who has visited these famous vacation lakes knows them as a maze of islands, rivers, channels and bays.

Agent Croucher is spending his second summer on the "Muskokalite". He took charge in the spring of 1946 when he went back into the water after being laid up for four years. The old engine had been replaced with a modern diesel developing 150 horse power, and when the time came for service to start Alvin had the ship gleaming in new coats of red, white and blue paint. To the cottagers she was a glad reminder that the rationing of war years was gone and again there was gasoline to power their boats.

Imperial Oil Agent Alvin Croucher and helper Elton Sawyer make a typical cottage delivery. Bringing the 95-foot "Muskokalite" into docks both for small pleasure craft takes skill handling the "Muskokalite". He took charge in the spring of 1946 when he went back into the water after being laid up for four years. The old engine had been replaced with a modern diesel developing 150 horse power, and when the time came for service to start Alvin had the ship gleaming in new coats of red, white and blue paint. To the cottagers she was a glad reminder that the rationing of war years was gone and again there was gasoline to power their boats.

Engineer, cook, general helper—Elton Sawyer is the one-man crew of the "Muskokalite". Elton was born in Muskoka, and is sure no other place in the world can compare with it.

At Port Carling the skipper and crew turn out to operate the locks which take their boat into Lake Rosseau from Lake Muskoka.
HE AIDS AGRICULTURE

R. P. FREY, SPECIALIST IN SCIENTIFIC FARMING, HELPS FARMERS SOLVE MACHINERY PROBLEMS BY HIS WORK WITH IMPERIAL'S FARM SERVICE DEPARTMENT

Raymond P. Frey, B.E., M.Sc., is an unusual man working in an unusual job. He is a practical farmer from Saskatchewan, an ex-newspaperman, and a former university professor. And for the past two years he has been consultant and supervisor of Imperial’s farm service department.

An agricultural specialist is, perhaps, a rather unexpected figure to be employed by an oil company. It is true the oil industry requires men of many talents and has large numbers of chemists, engineers, geologists and other scientists in finding and producing crude oil and in manufacturing and selling petroleum products. But Mr. Frey’s work is not primarily concerned with any one of these four major phases of the industry. Instead, his job is to help solve problems relating to the efficient use of power for farm machinery.

Together with W. Grant Underloy, Toronto, eastern co-ordinator, and J.E. (Ernie) Akitt, Regina, western co-ordinator, Mr. Frey directs Imperial’s farm activities in cooperation with the Company’s six regional farm managers from coast to coast. One of his important tasks is to study the application of petroleum products to Canadian agriculture.

There are more than 7,000,000 farm homes in the Dominion and all of them use petroleum in some form. One out of three farms in Canada has a tractor; two out of five have automobiles; one in five has some adaptation of the gasoline engine for power production; one in five, a threshing machine or combine; and one in eight, a truck.

The increased mechanization of agriculture, particularly in the prairie provinces, means that farmers have a growing need for advice about the most efficient use of petroleum. Canada has approximately 252,000 tractors, of which over 30,000 are in Saskatchewan. It is logical that a Saskatchewan educationist with years of practical farming experience should be chosen for an important post with Imperial’s farm service department.

Mr. Frey supervises the organization of “farm meetings” and of “tractor clinics” where individual farm machinery problems are discussed. He supplies technical information to help the Company’s farm service engineers in the provinces; he arranges training for Company field men; and he conducts research on special farm problems, the most recent of which was a survey in South America for International Petroleum Ltd.

“Doc” Frey was born on Oct. 17, 1902, on his parents’ farm at Lovel, Ill., near Chicago. When he was four years old, his parents moved to Canada with a colony of Illinois settlers who had decided to make a new life in Saskatchewan in the pioneer days of that province. As a youngster in his teens, Ray often hauled a wagon-load of wheat by teams from his father’s farm 12 miles to town.

His education began at the district “little red schoolhouse,” which actually was white clapboard, where he studied until completing Grade 8 although company representatives, specially trained in rural problems, visit farmers regularly. Advice on the care of agricultural machinery, including tractors, is part of Imperial’s service.

He had his share of man-sized chores on the farm. For the next year he drove five miles every day by horse and buggy to high school at Briercrest, Sask. Then his parents moved from the farm south of Moose Jaw into the city where Ray finished his collegiate education.

For a year he worked as a reporter on the Moose Jaw Evening Times but decided that farming was his real interest and he enrolled as an agricultural engineering student at the University of Saskatchewan where he obtained the degree of Bachelor of Engineering (Agriculture.) In 1930 he took a two-year post-graduate course in one year at Iowa State College, Ames, Iowa, long considered the leading "ag" engineering school on the continent. An earlier Iowa State graduate was Prof. Evan H. Hardy who became head of the agricultural engineering department at the University of Saskatchewan, first Canadian university to specialize in the subject.

Also in 1930, Mr. Frey took over the management of his father’s 600-acre farm. He had always been interested in mechanics and now that power farming had become the rule he was in his element. For the next four years Ray ran the farm in the summers and lectured at the University in the winters.

His teaching duties increased in 1936 and he joined the permanent staff of the University under Prof. Hardy. For the next 10 years, Frey also carried on university extension work, conducted numerous farm machinery field days, lectured at agricultural rallies, wrote extensively about farm machinery, and took part in educational radio broadcasts.

One in every five of Canada’s 7,000,000 farm homes has a threshing machine or combine like this for the annual grain harvest.

Mr. Frey values most highly the practical knowledge of farming which he obtained as a young man. His later studies in soil science, field crops, horticulture and related subjects have put this early experience on a scientific basis but he emphasizes: "The majority of agricultural engineering students have, and should have, a practical farm background. It is necessary to understand the true problems of the farm. It is a great help to me in my work."

The transition from the classroom to his present occupation has not been a drastic change because he retains his close connection with agriculture and it sharing his knowledge with Company personnel, dealers and local agents helps to stress the importance of supplying the right fuels and lubricants for farm needs.

He held a commission in the C.O.T.C. at the University of Saskatchewan and early in the war at the request of military authorities organized a service unit. He became commanding officer of No. 6 (R.) Brigade Workshop, R.C.E.M.E.

Before joining Imperial’s farm service department in 1945, Mr. Frey was chairman of the Saskatchewan Provincial Farm Housing Committee and of the farm building plans sub-committee of the National Committee on Agricultural Engineering. He is a member of the Society of Automotive Engineers, the American Society of Agricultural Engineers, the Agricultural Institute of Canada, and the agricultural development committee of the American Petroleum Institute.

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Mr. Frey works out of Toronto and travels widely in Canada. Early this winter he flew to Colombia in South America.

"The Colombian government has very progressive plans for the development of agriculture including research and experimental stations," he declares. "The rural population is definitely interested in mechanization. Many of the large estates own tractors and Colombian farmers are very anxious to learn all about them. The rural folk have graduated almost overnight from the general use of horses to become tractor drivers. Similarly in transportation they have jumped from the burro to the automobile. As a result Colombia is recognized as one of the leading "air-minded" countries of South America."

Out of a population of about 30,000,000, Colombia has some 721,000 farm homes, close to the proportion in Canada. While coffee forms 21 per cent of the nation's agricultural production and bananas and sugar cane are next in importance, Colombia grows grain, raises cattle and operates dairy farms by methods like those used in Canada.

On his way to Colombia, Mr. Frey visited Guatemalan City for talks with U.S. Ambassador E.J. Kyle, former dean of agriculture at the Agricultural and Mechanical College of Texas who has made an agricultural survey of most of South America. Mr. Frey also visited the Pan-American Agricultural School at Trujillo, Honduras, operated by the United Fruit Co. He is much impressed with this school which is attended by young men from 13 Latin American countries who receive a three-year practical agricultural course. Since his return he has given several addresses about comparative farming methods in the various parts of the hemispheres.

Mr. Frey married a fellow graduate of the University of Saskatchewan in 1939. Mrs. Frey specialized in dairies and home economics. They have two sons and a daughter.

In his college days Mr. Frey played basketball and rugby and continues a keen interest in these sports. He was captain of the University of Saskatchewan basketball team, Western Canada Inter-varsity champions in 1932-33. Later he was coach or manager of other university championship rugby and basketball teams, and held executive positions with several athletic organizations including the Western Intercollegiate Rugby Union and Canadian Rugby Union. He was president of the Basketball Referees' Association and refereed the Dominion playoffs and exhibition matches of the famous Edmonton Grads when they played in Saskatchewan.

His other hobbies include photography and growing flowers and vegetables in the garden of his Toronto home. "But I'm strictly an amateur gardener," he says.

\[G. V. Parkinson\]
\[J. D. McGilvery\]
\[W. J. McPherson\]

1947 FELLOWSHIPS AWARDED

ANOTHER GROUP OF FOUR YOUNG CANADIANS WILL CONDUCT POST-GRADUATE SCIENTIFIC RESEARCH THROUGH IMPERIAL OIL GRANTS

The 1947 awards of Imperial Oil graduate research fellowships have been made to two young men from western Canada and two from eastern Canada, all four of whom have had brilliant scholastic careers at their respective universities. Each fellowship is worth $1,000 a year and may be held for three years.

The fellowships have been awarded to James Duncan McGilvery, Hamilton, Ont., and Burnie, Ont., for research in chemistry; William John McPherson, A.F.M., Saskatoon, Sask., for research in petroleum engineering; Geoffrey Vernon Parkinson, Vancouver, B.C., for research in mechanical engineering, and Thomas Parks, Thanesford, Ont., for research in petroleum geology.

The awards were made under a plan introduced last year by Imperial to encourage post-graduate scientific research by young Canadians. The winners are under no obligation to the Company. Applicants are nominated by the universities and the applications carry no clause about employment or other form of association with the oil industry. The subject of research in the field for which the fellowship is awarded is a matter of arrangement between the fellow and the university he plans to attend.

Fellowship winner James D. McGilvery, nominated by McMaster University, won Hamilton Alumni Club and City of Hamilton scholarships and the Governor-General's medal during his course at McMaster. After graduation he worked with Canadian Columbia Ltd., at Drummudville, P.Q., and later with the Polymer Corporation of Burnie, engaged in fundamental physical chemistry work with high polymers, determining the molecular weight distribution of nitrile synthetic rubber. He proposes to take post-graduate physical chemistry at McGill.

\[Thomas Parks\]

August 1947
OF ALL THE varied occupations of the oil industry perhaps none offers greater excitement, greater challenge or greater potential rewards than that of the field geologist.

In Canada the field geologist works chiefly from the U.S. border north to the shores of the Arctic, and from the slopes of the Rockies far out into the western plains. He travels by canoe, automobile, pack horse, dog team, aircraft, river boat and on foot. He often meets wild animals that have never before been mankind and sometimes finds it necessary to take evasive action before the single minded purpose of a grizzly or cinnamon bear. He pores over remote rock outcrops looking for fossils which were living things hundreds of millions of years ago. He determines the surface and estimates the subsurface rock structures. He goes to bed in a sleeping bag or in some foothills village and dreams he is a geological Sherlock Holmes who has discovered in one of the cobble bearing sands within a mighty rock trap. He arrives back at civilization again lugging several hundred pounds of ancient rock, with manuscript books full of meticulous notes and displaying an unquenchable optimism about the search for oil in Canada.

The field geologist is the shock trooper in the widespread, costly exploration program which Imperial Oil and other companies are prosecuting to provide Canadians with a natural resource that is vital to their comfort and well-being in modern civilization. Oil may be found in the sedimentary deposits of ancient seas which in bygone ages ebbed and flowed over North America. This also means that other areas, notably parts of the Maritimes and Ontario, are being explored. By far the greatest deposits, however, are in the west and it is here the search is most intensive. Imperial has had six to seven parties in the field this summer, probing from British Columbia to Manitoba, from the border to the far north. The Company has done almost half of all the field geological work in western Canada.

The field geologist rarely operates alone. It is neither safe nor practical. Quite often two-man teams go out, but usually a party consists of three or four. The field geologists and subsurface parties will work from a central base in the field.

Where possible a trip begins with a general reconnaissance. The pilot of these craft are intrepid adventurers, expert in landing on unknown, perhaps even unmapped mountain lakes. Often in the north their compass will spin and turn with as little attention to a straight course as a puppy on a new street. They must depend on a river bed, a range of hills, on experience, and their own shrewd observations to bring their party safely back.

Wherever he can do so the geologist follows a river. Rivers provide him at once with opportunities to examine outcrops of bedrock and a path back to civilization. The hundreds of streams and rivers which flow down from the great divide of the Rockies are ideal for this purpose.

After the aerial reconnaissance the party prepares for the ground trip. It is usually possible to estimate the time it will take to cover the stream from its headwaters to a rendezvous such as a junction with the Mackenzie River by a careful noting of such things as the frequency of rock outcrops and the number of portages which will be necessary. This in turn will determine the size of the expedition. A four-week trip will probably require 800 pounds of equipment and supplies and two canoes.

Next the group is flown in by air and landed at some mountain lake near the headwaters of the river which they intend to explore. Often the aircraft will cache additional supplies some distance down river.

It is a tribute to the resourcefulness of Canada's oil seeking geologists that there have been few serious mishaps. There have been some incidents, however, which have been grim enough—for instance, the unhappy experience of the Imperial Oil party which had landed above the Grave River in the Northwest Territories.

On the way in, they spotted a canoe and a cache of supplies along the river. Then the aircraft left the party on a lake which fed a small stream flowing into the Grave. The men were to work the hills along the lake, then move down to the Grave, pick up the extra canoe and additional supplies and proceed down the river. When the hill work had been completed their supplies were almost exhausted, and before they were ready to move on a heavy, steady rain set in. In the headwaters area a heavy rain causes a swift rise in streams and rivers and it is not unusual to see a mountain stream rise eight or ten feet overnight. Thus the party watched the small stream become an impassable torrent and found itself marooned of all food. After waiting for the stream to subside partially, they set out for the Grave and their cache.

Luck was against them. The canoe capsized and everything was lost. One man who couldn't swim was rescued. The group set out on a tortuous journey by foot, without food, to find the cache and the other canoe. Before they had gone far, one fell ill.

The ingenuity of P. T. Blanchet, a geologist who is now stationed at Calgary, probably saved the day. He managed to make a hoe and some arrows and with these shot two squirrels which the men ate. Along the way the group chanced upon an abandoned Indian encampment where they found a porcupine noisily about. Fortunately porcupines are slow-moving animals and they killed it without difficulty.

When they cleaned it they found the flesh was very good. They discarded some and ate the rest; the next day, with hunger gnawing at their stomachs and faced with the possibility of starvation, they came back to cook and eat what they had discarded.

Finally they arrived at the Grave, but the extra canoe and cache were at the opposite side. They built a raft, but it broke up when it got into the stream. Then they built a second raft, and Blanchet finally got across. With the canoe the party went directly down to the Mackenzie with the sick man, who was flown to hospital in Edmonton. Blanchet, undaunted by the experience, was flown back in again. In addi-
tione to completing his exploratory work he found the canoe which had been lost, stiffened it with poplar sapling for a gusset, patched it and brought it back to Norman Wells.

The Gravel River party was not the only one to come to grief in recent explorations in the Northwest Territories. W. (Willie) F. Hancock and Donald Wettersberg were swamped in their canoes on the Redstone River, not far from its headwaters at the dividing line of the Rocky Mountains. It happened suddenly; they rounded a sharp bend in the river, and immediately found themselves in a heavy current with big "rollers". The canoe turned over, and the only items salvaged were the canoe itself, a survey rod, a small but heavy geologist's instrument called an alidade, a small pack containing a piece of bacon and a bit of ham, and some sugar, raisins and prunes. Clothes, paddles, supplies—everything else—were lost.

Hancock and Wettersberg first thought they would try running down river, using the two halves of the survey rod for paddles. They knew that by land it was 80 miles of wild, broken country, with three intervening mountain ranges and some muskeg. The river ran between high canyon walls, had a number of swift rapids and some portages.

One day on the river was enough. After some hair-raising experience with the awkward, heavy survey rods in the place of their deft paddles, the men decided to cache the canoe and take their chances on foot. Their food was pitifully low and they had no clothing except the cotton slacks and shirts which they wore. These were all right during the day, but were inadequate during the very cold nights.

Eleven days after the accident, when they were about to boil, their hands frozen for lack of a fire, they bailed a U.S. Army boat from the banks of the Mackenzie. Both men were exhausted, suffering from exposure and hunger, and their faces were so blackened from sleeping near fires for warmth and safety that the Americans thought they were negroes. Their clothes were in tatters and hopelessly patched with rock sample bags and canoe patching gum. They had existed chiefly on berries, which they had sometimes eaten under the curiously eyes of bears which had come down from their native haunts to feast on the fruit. They had no trouble with the animals, but long remembered the more unreasonable Brauns which stood in the shadows of their campfire and watched them.

Such are the potential hazards of field geology. The geologist who works by canoe learns to listen automatically for the sound of the waters ahead; from their murmur, chatter, or roar he will know of a falls around the bend ahead, of a rapid, of the tightly compressed currents that move swiftly between high canyon walls. With something akin to panic he may experience the "piled up" waters in the middle of a fast-moving mountain stream. He discovers, above all, that a drowned geologist finds no oil, and takes his chances with his gruelling portages accordingly.

It is now the custom to contact parties in the field regularly by aircraft. Imperial operates its own planes and also charters air transportation as necessary. This regular contact ensures the safety of the men, who might work a month or more without seeing a person, and also provides an opportunity to supply fresh food and renew supplies.

An amusing incident arose out of one of the first air contacts with a party in the field. In a bower of enthusiasm 36 huge, juicy, fresh steaks were sent out to a large party working out of a central base in the wilderness. The donors, thinking of what a welcome change the steaks would be after hard hommock and dehydrated foods, completely forgot that most of the party would be on various exploratory expeditions some days out of camp. When the 36 steaks arrived the three amazed but delighted geologists who were on hand did their utmost to eat them.

A common method of transportation for geological parties in the foothills and adjoining hush districts of the Rockies is the pack train. Pack horse parties become very much larger than the canoe parties, because it is necessary to have many horses and these in turn require extra "packers" and their assistants. With the increase in numbers it is usual to add a cook. Normally camps are made every few days, and geologists, working with saddle horses, scout the adjacent area and then move on to another campsite. Many are the stories told of the packers, who are resourceful, experienced "horse-wranglers" who make their living by renting their strings of horses and their own services to big game hunters and others who want to visit otherwise inaccessible regions. Their work makes them lonely observers, and often a packer who is a veteran of several geological expeditions will embarrass a young geologist by announcing they have just passed by an outcrop, dipping south-west at so many degrees... actually, however, the packer's knowledge of the country is a great asset.

After the camp is made the packer has a great deal of time on his hands. There are large bands of wild horses in the foothills of the Rockies, and often packers amuse themselves by roping and taming these horses. Occasionally they bring a snorting, wild-eyed stallion into camp, an achievement which calls for no small praise.

The most extraordinary geologist who walked out to a group of corralled horses, selected a likely looking beast, threw a bridle and saddle on it and mounted. The beast refused to move. He checked at it, slapped it and dug his heels into its ribs without results. Angered, he dismounted, cut himself a generous switch, remounted and proceede to lassosphate the animal down the trail. When a great expenditure of time and energy had nettled him a distance of several feet he gave up in fine disgust and took another horse.

Rivers and canoes provide one of the main means of transport for geologists. The average cost of maintaining a geological party in Western Canada runs from $1,500 to $2,000 per month.
"My God!" the packer rejoined. "You didn't ride that animal? That's a wild horse I caught yesterday and I've been trying to get up nerve enough to put a rope on him again!"

Most parties carry guns, but for sport rather than protection. A gun is a heavy encumbrance when one is already burdened with the geologist's tools, and if needed a man would seldom have it at hand. However, at least one member of a geological party—Fred Morris—is thankful he carried a revolver with him. Morris was working about 50 miles north of Eldon, Alta., on the Athabasca River. He was crossing through some low patches of alder when he realized he was in one of the worst spots he could find himself—between a mother bear and her cubs. Morris fled to the nearest tree and climbed it. The mother bear rounded up her cubs, chased them up another tree, and then started after Morris. With his heavy revolver he was able to win the encounter.

While the most intensive search for oil is in the foothills and adjoining plains and bush country, the field geologist also ranges far out over the prairies by truck and automobile, and he has visited most small western towns. In the far north he has been known to work by dog team and snowshoes, especially during winter operations. However, field parties are the best method yet devised for general "mountain front" exploration, so their greatest effort ranges along the eastern slopes of the Rockies, and their favourite modes of transportation are aircraft, canoes, and pack horses.

The tools that field geologists carry with them are relatively simple. Even present in the plane table, a flat board which is mounted on tripod legs. The most complicated instrument is the altimeter, which might average in cost about $500. It is used to measure distance and determine elevations.

The Brunton compass, in addition to showing direction, is also an inclinometer and is one of the hundred of the field man's tools. The theodolite, used for picture taking at the turn of the century, is employed to give perspective to aerial photographs. There is always the geologist's hammer, used for chipping rock, and the trenching tool, with which a trench is dug into the earthy covering to show the sloping side of a canyon so that the rocks underneath may be examined. There are slide rules and books of mathematical tables and logs for fossils and samples of ancient rock.

When he puts these tools to work the geologist becomes a sort of detective. His clues are the relative elevations of the bedrock which crops out here and there, and which may be seen especially well in the deep canyon rivers cut. The villain he is hunting for is a hard rock structure which in its simplest form might be like a sewer or a cup turned upside down. He knows that ancient seas once flowed over parts of this continent, and that at the foothills there are sediments which extend more than two miles down. He knows that the countless billions of marine things which died in those seas fall to the ocean floor and from their substance, by the obscure processes of nature's handiwork, oil was formed. He knows that the oil worked its way upwards through porous rocks, and that it escaped—unless it got caught in an impenetrable rock trap beneath the surface.

So he watches for movements in the earth's crust, and for evidence of deeply-buried hills, precipices, ridges—which in his language become faults, anticlines, and domes. He picks a marker, perhaps a narrow band of volcanic ash which erupted from the mountains which used to stand in the Pacific to the west of the Rockies. This band may now be a white volcanic ash bed, and may spread its thin seam over a quarter of the world which at the time it was deposited was under water. He sees it here, beside a stream, and notes the elevation. It occurs again by a river, and again and again. He notes the elevations. He finds places where pressure has forced the rocks up from below and thrust them upon the surface. He chips bits off and finds a fossil whose short life-spans as a marine thing occurred fifty million years ago; this opens to him a whole story of geological information. He carefully preserves specimens from every location for further study and correlation with the finding of other parties in adjoining areas.

Finally, with all his clues together, he formulates a theory. Perhaps there is no promise of an oil-bearing structure in the thousands of miles he has traversed; perhaps there is one perfect for bearing oil. If there is, his work will be doubly checked and narrowed in locality by fellow geologists working with such complicated and expensive instruments as the gravimeter and seismograph and perhaps the core drill, all intended to trace the subsurface contours of the rock formations. Lastly, the company he represents may take up reservations and spend upwards of a million dollars to drill a hole which may be more than two and a half miles deep, and even though the geologists have found a perfect rock trap for oil the drills may discover the elusive fluid trapped perhaps ten or twenty million years before.

If he finds no oil he has still done his duty well. It is given to very few to find an oil field; his probable destiny is to grow in knowledge and experience, and graduate to supervisory and executive work at the base of operations, and if some day in an exploratory program that may cover roughly a third of the nation his deductions send a young geologist to pinpoint in new field he will feel well rewarded.

Apeats ago, tremendous heat and pressure created these rocks into diamond shape. Here a field geologist with a Brunton compass measures the angle at which they dip under the ground.
"EX" RE-OPENS

THE RE-OPENING of the Exhibition at Toronto on August 22nd after a war-caused lapse of five years is an event of international interest.

Canada's greatest fairground found a tremendous wartime use when it housed thousands of servicemen. Thus the "Ex" buildings and surroundings became familiar to many Canadians who had never visited them in peacetime. Many will come to see the Canadian National Exhibition resume its traditional role.

Except for the 1941-42 war interruption, an annual fair has been held in Toronto since 1879 when the Industrial Exhibition was formed "for the encouragement of agriculture, horticulture, arts, and manufactures." Re-named in 1912, it grew from a provincial enterprise to become the world's largest annual exhibition.

The 1947 C.N.E. will have many new features. Some $2,000,000 is being spent on renovation and modern construction including permanent buildings for the colorful midway. The program also provides for a $2,000,000 grandstand to be ready next year replacing the one destroyed by fire in 1946.

During World War II the C.N.E. became a vast military depot. Reconstruction has kept a peacetime army of workmen busy for the past year. Landmarks like the Dufferin Gate have been renovated. Here the Graphic Arts Building gets a new facade.

Exhibition Park has played a major role in three wars. In World War II it was a Navy and Army centre and the chief RCAF manning depot. Later, it became a demobilization point where many returned men were re-united with their families.

C.N.E. industrial displays have helped to develop industry in Canada. The above pre-war exhibits in the Automotive Building depict the output of Imperial Oil services. This year Imperial's theme will be "Petroleum Promotes Progress."
SAFETY IS NO ACCIDENT

WORKERS in the petroleum industry are not engaged in a particularly dangerous form of employment. Oilmen know this, but people outside the industry are inclined to think of the production, refining and transportation of petroleum as a peculiarly hazardous way to earn a living.

This misconception arises from the dramatic nature of fires in drilling fields, refineries or tankers at sea when they do occur. Actually the incidence of fire and accidents in the oil business is remarkably low in comparison with other industries. If people generally, in their own homes, on the streets, in offices and other work centres were to exercise the same good sense and simple precautions that are day-to-day practice in the handling of petroleum, loss of life, maimings and occupational illnesses could be greatly reduced in Canada.

"Eternal vigilance is the price of safety," remarked an official of Imperial Oil's marine department. "Few things are dangerous if you handle them properly. That goes for other activities besides those of the oil business," he added with a twinkle.

Through the years since its beginning the petroleum industry and Imperial Oil in particular have given intensive study to the causes and prevention of fire and accidents. Practical results of these efforts have been most satisfactory.

The Company conducts a continuous campaign of safety education among its employees to prevent anything from a major disaster to a minor personal injury. The Company investigates the basic causes of all accidents and takes all possible steps to prevent their recurrence. Information gained in this way is distributed to personnel in a monthly accident bulletin.

General surveys show that mechanical defects cause only seven or, at most 10 per cent, of all accidents. Physiological causes—such things as inadequate lighting, improper ventilation and bad housekeeping, which in industry means leaving a spill of oil or a loose nut on the floor where it may cause a workman to slip or trip—account for from 23 to 25 per cent of the mishaps.

Giving these causes, mechanical and physiological, their fullest value, 68 per cent. of all accidents remain. These have been found to have psychological causes. Workmen who are unsuited to their particular employment, who are unhappy in their personal lives or maladjusted to their fellow workers who are negligent, reckless or inclined to disregard an order are the people involved in the majority of accidents.

While it is beyond the power of any company to see that all its workers are perfectly happy, Imperial strives continually to maintain the best possible working conditions and the high morale among its employees acts as an accident preventive.

Industry has a definite stake in accidents that happen to its workers in their homes. In the United States statistics for a single year show that 35,500 persons died in accidents in the home compared to 16,000 involved in occupational accidents. Between 1928 and 1945 fatal accidents in the home showed an increase of 12 per cent. While industrial accidents for the same period declined by 16 per cent. Similar conditions prevailed in Canada.

It is significant that very few accidents befall Imperial personnel in their homes—proof that the Company's policy of safety education is effective outside its actual plants.

All personnel joining Imperial Oil are given a physical examination and are taken not to place any person in employment for which he is not physically capable, both as a protection to the individual himself and to his fellow workers.

In addition to the informative monthly accident report, and other circulars, Imperial Oil provides safety instruction courses. These courses teach the worker accident hazards that exist in any particular job and how he should offset them. Employees are encouraged to realize that the chance of not being injured is in direct proportion to the attention given to accident prevention training.

Posters keep personnel acquainted with both common and unusual accident hazards likely to exist in their work. They deal with the particular, avoid general statements, and give terse, constructive information on such things as right and wrong methods of lifting a heavy weight or unloading a barrel from a truck.

Certain safety precautions, such as the flying of a red flag when loading or unloading petroleum products from tankers, have become international practice. Others are based on federal and provincial regulations.
However, Imperial has gone beyond the legal rules of safety in its efforts to educate and safeguard its personnel. This is because of a genuine concern for the workers themselves. There is no measure of money to make up for the mental anguish and bodily pain caused when a worker is killed, maimed or temporarily injured, either for himself or his family. The employer loses a faithful employee and valued friend with a corresponding loss in Company morale.

Fire is the most obvious hazard in the petroleum industry. In handling flammable products the danger from fire occurs when they come in contact with the air. The threat of fire is negligible if maintenance is in first-class condition to prevent spills or leaks. Rigid inspection is maintained and the Company stresses fire prevention measures as the essence of fire protection. Educational films on fire prevention are shown periodically to plant personnel.

As an illustration of the results in the past 20 years the Company has operated an estimated annual average of 3,000 above-ground gasoline storage tanks under control of the marketing department. The number of breakages in tanks or pipe line equipment does not exceed 1 in 200th of one per cent, per year of the total tanks installed.

On each occasion where breaks did occur the leakage was observed shortly after the break took place and the damage was confined to the loss of liquid and repair to the valves. No fires resulted. The majority of the breaks in the main and water draw-off valves occurred when the valves were made of cast iron. Present day construction specifications cast steel for both main valves and water draw-off valves. Rigid specifications for construction and maintenance have been introduced to offset the threat of breakage through corrosion or other deterioration of materials.

The Company maintains wherever they may be needed, portable hand fire extinguishers, fire trucks to fight large fires and permanent plant installations operated by reserve control valves to dispense fire-killing liquids such as foam, carbon dioxide, steam or water. Constant fire drills keep workers fire conscious and reveal fire hazards. Fire prevention is built into units and fire walls guard tanks.

Fire at sea is an ancient horror and one against which every possible precaution is taken on Imperial’s fleet of tankers. Steamships are equipped with steam smothering devices through which steam is piped to all oil tanks and can be released by the opening of a valve. Diesel-powered ships are equipped with what is known as the “Lux” system. This consists of highly compressed carbon dioxide gas in batteries of steel tanks from which a remote control lever releases the gas. They also have foam systems of various types which act like a bubble bath and smother fire by shutting off the oxygen. All ships are equipped with hand extinguishers as well.

The fact that structural strength and division of cargo tanks are divided by bulkheads or water walls helps to prevent the spread of fire before it can be smothered by steam or foam. The compartments that separate different kinds of liquid cargo on the same ship also prevent too much wash of tank contents with motion of the ship.

Great care is exercised during the loading and unloading of petroleum cargoes. A tanker cargo may be as much as 135,000 barrels or 4,725,000 gallons of gasoline, and the importance of these safeguards cannot be over-estimated. Before loading and unloading operations are begun, static ground wires are run ashore to drain off static electricity from the ship and dissipate it harmlessly. This is a precaution against a spark occurring at the end of the discharge hose when it is being connected. During electrical storms all loading and unloading stops.

In the handling of highly volatile products such as castinghead gasoline, the loading is conducted in a closed circuit and the gas taken aboard is exhausted safely. In this operation the gas is pumped directly from the cargo tank and led through pipes to a safe area—often as much as a quarter mile from the docks. In the case of hexane, there is a system of pipes leading to the air just above the dock—where it is dissipated in the presence of steam. The steam is an additional safeguard against fire.

On ships that transport petroleum products open electrical switches or open light bulbs are prohibited. Electric light globes are protected by water-and-gas-tight coverings.

Fresh air masks of various types are used for men working in tanks which may or may not be free of gas. Gas detectors called explosion meters are used to test tanks before men enter them. This apparatus indicates the presence of gas and prevents the workers from entering tanks where the gas concentration is unsafe. When a tank is described as “safe for man and fire,” it is known to be completely gas free and there is no danger from operations such as use of a welding torch. If work is to be continued for days, tests are conducted frequently.

For cleaning tanks in ships that carry petroleum products, Imperial employs "the Butterworth cleaning system." This uses an apparatus that looks something like an outsized garden sprinkler operating on two axes, vertical as well as circular. It washes out the tank with very hot water, eliminating the hazard of manual work of tank cleaning and making it unnecessary for men to enter tanks which might contain gas.

Procedures similar to those used by the marine department are taken in loading and unloading railway tank cars and trucks. Ground wires are attached to the rails to drain off static electricity that might be a fire threat. The same principle is behind the chain that "grounds" automotive vehicles carrying petroleum products.

In production fields working conditions exist today that present a sharp contrast with operations 30 years ago. Many are the result of constant attention to the problems of safety.

Each tank in a refinery is surrounded by a dike to isolate a fire if one should break out. Other safety features include high-pressure water units like the one shown in the picture below the caption. These two arrangements stand guard over a gasoline storage tank. They keep the pressure inside the tank constant and each contains a flame-arrester as a protection against fire.
Color plays an important part in the prevention of accidents. The safety department has a high appreciation of the value of interior painting of walls to provide adequate light. Light or bright colored paint draws the attention of machine operators to fast-moving parts which might cause accidents.

It is in the interest of safety that each worker be properly dressed for his work. Goggles and face masks are provided by the Company where there is danger to the eyes of workers. The use of equipment such as heavy gloves, safety shoes with non-skid soles, and steel toe caps to prevent feet being injured by falling weights, is encouraged.

Many other devices are in use in Imperial's plants for the protection of workers. Telephone pole guy wires have shields and are indicated by striped painting. Guards on rising stem valves prevent head bumps. Safety ladders have hoops and non-skid feet are used. Gas detector apparatus like that employed on tank ships is used before hot work is permitted. Buildings, tanks, towers and processing units, are equipped with emergency exits. There are safety valves on equipment and blow-down devices for emergency shut-downs. All equipment is frequently inspected for corrosion and wear. Alarms indicate the presence of combustible or dangerous gas. Walls and stairs are non-skid. Pressure vessels in processing units adhere to safety standards. Floodlights add safety to night operations.

Wherever acid or lime used emergency showers are ready for cases of accidental spraying. All workers are taught that if a person accidentally gets chemicals in his eyes he should wash them out immediately with great quantities of clear water. Acid and lime piping connections are equipped with sheet lead shields to prevent spraying.

Respirators are provided as protection against clay dust, gas and the like, and inhalators are always in readiness for asphyxia emergencies. In tank cleaning operations one man is stationed outside and one inside, the latter equipped with a safety rope to help in his rescue if he is overcome by gas fumes.

Salt tablets are provided for workers as a preventive against heat prostration in refineries and drilling fields.

In short, accident prevention has long since ceased to be a set of rules laid down by government boards or company management which workers are required to obey. Rather, Safety has become a commodity, something to be preserved with the utmost care and which the worker appreciates. The premium he pays to ensure safety consists of care and vigilance, good housekeeping in his work place and avoidance of all possible risk. Industry as a whole, management and worker alike, attain through these precautions greater security, smoother operations and higher morale.

Increased happiness as a result of greater safety is intangible, but extremely vital to industry.

This modern cable tool rig, owned by R. McMaster and Sons, is working in southwestern Ontario where Imperial's exploration program has found new oil in Canada's oldest oil area.

Cable tool drilling, adaptation of an ancient Chinese method, is still being used to find new oil in Ontario.

Yu Sung jumped from the platform on to the springboard, which sank under the impact of his weight. His feet hurt, for he had jumped hundreds of times that day but he climbed to the platform and jumped again. This was two centuries before the Christian era and Yu Sung was drilling for salt.

Sung was working with a very simple apparatus. There was a spring pole 40 to 60 feet long with a springboard attached. At the small end of the pole a line dangled into the drilling hole. At the end of the line was a crude drilling bit which pounded deeper into the rock each time Sung jumped. He was using the ancestor of the present-day cable tool rig, still an important method of drilling for oil.

Improved and adapted to meet new conditions, the Chinese drilling apparatus found many uses over the centuries. The spring pole was still used as a drilling mechanism in the 1860's when the first Canadian oil wells were drilled. Instead of jumping on the springboard, men walked back and forth on it to supply operating power. Steam power, however, had already been used in drilling and soon displaced man power. Still later, gasoline and diesel engines gradually replaced steam as the motive power for both cable tool and rotary drilling rigs.

Rotary drilling for oil was introduced about the turn of the century. Where the cable tool drills "pound" their way down, the rotary drill is a bit which rotates on the end of a string of "drill pipe" and "grinds" its way through the rocks. The rotary drill is now more widely used than cable tool and most western Canada wells are drilled by rotary.

The cable tool method is far outdated, however, and is still being used exclusively in Imperial's search for oil in southwestern Ontario. Starting in July 1945, these rigs have drilled 8.5 wells, of which eight were oil producers; one gas producer and 66 were dry holes. Fields have been discovered at Becher and Wilcoxcroft. The first has six gas and two oil wells; the second at first produced a fair show of oil, from six wells, but production has since declined to a barrel a day per well. At Kimball one well has come in with a small production and there are promising prospects for a field in this area.
These wells were drilled by essentially the same method. Yu Sung used, by raising a heavy drill and dropping it with shattering force so that it annuls its way through rock. Cable tool rigs are not as expensive to operate as rotary rigs, and the driller has a better chance to detect shows of oil or gas.

The advantages of the rotary method are that it can reach greater depths, it works faster and the drilling mud used permits a greater measure of control. The mud also seals off water and prevents caving to a certain extent, whereas the cable tool driller might have to run casing.

This method is used in south-western Ontario because formations there are more suitable for cable tool than for rotary. The formations are large limestone with considerable chalk, or Flint, which breaks up readily easily under a cable tool hit but which rapidly wears out a rotary bit.

Once the geologist has selected a location wherein oil may be trapped, the drilling contractor moves his rig to the site and sets up the derrick on heavy timbers or concrete block foundations. The derrick may be from 75 to 150 feet high. The "crown block" tops off the derrick. It is a frame in which pulleys are mounted and over them run cables for the "casing line," for raising or lowering casing; the "drilling line" for raising or lowering the drilling tools and the "mud line" for hoisting and lowering the bucket.

Yu Sung’s springboard has been replaced by a "walking beam," and a gasoline or gas-powered engine. The engine drives a wheel, the wheel drives a connecting rod known to oilmen as a "pittman" and the pittman works the walking beam up and down raising and dropping the tools which smash the rock. The principle is the same as that of Stang’s drilling apparatus and the result, the same.

The walking beam is not used when the well is being started. It is "spudded in," to the driller. A special bit is used for the first 100 feet or so, until the drilling string, which is about 40 to 50 feet long, can open up. In this early stage the bit is attached to a main ram which runs over the crown block and down to a scratch in which rains are made and drops it. The rose is used to give more "whip" when spudding.

Once the well is spudded in, the drilling string is attached by the "wire line clamp" to the "temper screen," which is the drilling line and has the tools lower the tools.

The ability of a driller is indicated by his control of the temper screen. With his hand on the wire line clamp, he "gaites" how the tools are acting hundreds or thousands of feet below. If he lets out too much line, the tools will not come up high enough for a full blow and the stock line may lead to a crooked hole. If he lets out too little, the tools will not strike with their full momentum.

A string of cable tools weighs from two to five tons. The most important part of the string is the bit, which is firmly screwed to the drill stem. A swivelled at the top of the string, where the wire line is attached, permits the bit and stem to revolve freely. In the stem is a set of "jaws," which look as if they had been fashioned into two heavy links of a chain. Their function is to jar the bit free should it become stuck.

The bit appears to be quite blunt to the layman. Its job is to smash the rock into tiny pieces, not to cut through it. If it ever sharpens it will stick. Blunt as it is, it must still be "dressed." This is done by beating it red hot then attacking it with a "dodge hammer," a steam hammer. The driller and his assistant, the tool dresser, do the job and then temper it by rebuttering and reouching.

The rock which the bit shatters must be taken from the hole and here the bucket is used. Often nature provides enough water in the hole to keep the cuttings in suspension and out of the way. If not, water must be added. To fill the hole, the tools are run out and the bucket run in. The bucket is a pipe 10 to 20 feet long, with a hand-and-clamp valve at its lower end. When the derrick strikes the bottom of the hole it raises the bucket and the cutting-filled water runs into the bucket. Then it is raised, emptied through a "dump box," into the "dredge pit" and run in again until the drilling is completed.

Yu Sung would abandon his well if he struck a heavy flow of water, or if his drill met caving rock. The cable tool driller uses casing and gate boards. Casing is hinged, round, steel pipe, usually used in 20 to 40 foot lengths and in diameters from 3 to 12 inches. The joints of pipe casing are screwed together and lowered into the hole until the water or caving rock is sealed off. This casing is smaller than the hole, as a smaller bit must be used.

If subsequent casing is needed, it must fit inside the preceding string, and an new is smaller, the driller must make the initial diameter big enough to prevent "caving out of hole." Caving the diameter reduced to such an extent that drilling tools will be insufficient.

Yu Sung probably had a few simple tools for "fishing"—trying to remove something stuck in the hole.

For every five feet of hole drilled a sample is taken from each cuttings brought up by the bucket. When stuck in a barrel, the cuttings are then placed in a sample box as shown here.

Driller Mel Davis, standing on a flare boat, prepared to use the "knowledge friendly," turns the bongo string to give his drill more force. The winch drum is near below the ladder.

The cable tool driller uses a number fishing tools to help him. These boxes include such as slip, bucket, centering, sweep, sweep, sweep, centering, sweep, centering, sweep, sweep. The tools are used to catch the lost tool and bring it safely out of the well.

The driller must keep constant watch against accident to prevent fishing jobs. The cable may break, the casing may part, the bit may come loose, the bucket may be lost. Sometimes the "kit" is caught easily but difficult jobs may run into days or weeks. When fishing fails, the driller may use his drills to side track the obstruction and drill a new hole beside it. Occasionally yet stronger drills and the bucket are lost.

When the barrel breaks up inside of oil, a control head is fixed to the inner string of casing, with connections leading to a lead tank. Drilling proceeds cautiously and a disconnecting of the blow shows that oil is rising in the hole.

Cable tool drilling, first used in Canada some 50 years ago, is still bringing in productive wells.
CASH FOR IDEAS

NOW OPERATING ON A COMPANY-WIDE BASIS, IMPERIAL'S COIN-YOUR-IDEAS PLAN SUPPLIES SPECIAL PAYMENT FOR EMPLOYEES' INSPIRATIONS

O'NE EVENING about three years ago a man in Sarnia was sitting in the living room of his home half listening to the radio but really thinking about the day's work he had just completed.

The man had a small but persistent problem. He was a unit operator at Imperial's Sarnia refinery and part of his job was to supervise a clay and oil mixer, a step in the refining of lubricating oil.

His problem was that as the clay flowed from the bins it had to be timed. It seemed to him that he spent far too many minutes of the day looking at his watch or a clock and that there should be some more efficient check on the operation.

Just then, for some reason, he got up and went into the kitchen. He glanced automatically at the signal light there which was connected with the electric hot water heater down in the cellar. Everything was under control.

Back in the living room, he looked at the pilot light on the radio. As he sat down, he thought of the automatic bell switch of the refinery's refrigerated laboratory.

Then he had an idea.

Next day he submitted his suggestion at the refinery. As a result an indicating light was installed in the control room of his unit to show when clay is actually being injected into the mix. When the light is on, it indicates that clay is still pouring and reminds the operator when to take action.

The warning indicator assisted the operator in his work, led to a move exact use of the clay, and thus cut down wastage of raw material. For his suggestion the man received special award of $100 through Imperial's Coin-Your-Ideas Plan.

The Coin-Your-Ideas Plan has been in operation for many years in Imperial's marketing and manufacturing departments with such excellent results that it has recently been reorganized on a Company-wide scale. It is based on the belief that man on the job usually has the best ideas about what can be done to improve his own particular phase of the petroleum industry, and that he should be encouraged to submit suggestions and should receive a fair reward for those that prove practical.

Under the plan, when an employee gets an idea he thinks worthwhile, he (or she) submits it to the local or area committee for scrutiny. Immediately after

its merit is established, an initial award ($10 minimum) is granted. The suggestion then comes up for consideration for a supplemental award which may in turn bring a substantial cash return. Finally the idea is considered by the Plan's central committee which meets monthly in Toronto. The central committee decides on the capital awards of $500, $300, $200, and $100 for the four best suggestions submitted each year.

Employees in non-supervisory or occupational positions (and they are the large majority of the 10,000 Imperial workers) are eligible for all three awards (initial, supplemental and the annual "Jackpot") for ideas either within or outside the scope of their duties. Others in supervisory, technical, or key positions qualify for the first two awards provided the suggestions lie outside the scope of their regular duties.

Suggestions from both employee classifications (regular workers and supervisors or technical men) are eligible for awards if the ideas are new in application in the area—whether at one of the company's seven refineries, oil in the producing or exploratory fields, aboard an oil tanker at sea, or in the sales, transportation, or other offices.

The second requirement is that the idea, if adopted, must lead to improved operating efficiency or to an improvement in material or labor, or safer working conditions. Suggestions which are considered to be a routine part of an employee's regular job or which are an obvious development of work planned or under consideration naturally do not qualify.

All suggestions are considered and nothing is too small for review. There is a constant opportunity for the dreamer if he can bring his dream down from the cupboard.

The marketing department has been using the Coin-Your-Ideas Plan since 1927 and many of the suggestions made by employees 20 years ago have become regular practice today in facilitating business. Most of them are simple, matter of fact ideas, which make one wonder why they had not been thought of before.

As an example, a salesman suggested a marine log booklet for use in the fishing trade and for small pleasure craft along Canada's sea coasts. The booklet contains pages for daily log as well as information concerning the location of marine service stations, lighthouses and other facts. It has proved a real help and convenience to all operators of small craft in the area.

A sales field assistant suggested a chart showing the capacities and recommendations for all models of farm tractor radiators, crank cases, transmissions and differentials. This has been a boon to farmers and to Company agents doing business with them.

In the producing department, a driller devised an oil bath chain guard for the large and costly chains used on steam-driven rotary rigs. This has been installed throughout the producing fields and has been instrumental in increasing the life of the chain seven times. A welder, also working in the field, suggested an economical and efficient method for re-tipping used rock bits and resmiers which normally would have been discarded. He received an award of $300 for his "brain wave."

Many practical suggestions have come from the manufacturing department because there is great scope for change and innovation at the refineries.

A refinery worker at Regina had $250 more money to take home one day when he received an award for his suggestion of an improvement in one phase of the method used for separating aviation gasoline from heavier products in the distillation process. His basic idea led to a smoother operation and a better yield.

One steel cleaner "cleaned up" $150 when he invented a time and labor-saving device for pulling plugs out of furnace headers, but we won't try to describe the device. A thoughtful janitor at Halifax received an initial award of $10 for pointing out that a masonite shield would avoid stains on woodwork and stalls when polishing brasswork on door sills and light switches. And a car repairman at Vancouver obtained a similar amount of extra spending money when he suggested that pieces of discarded rubber hose could make excellent safety grips for hand tools.

These, and many other ideas have come from varied sources and from very different people. Some of the suggestions might be called "just plain horse sense" but no one benefited until they were thought out and submitted for adoption.

Over the years Imperial has found that the encouragement which the C.Y.I. Plan has given employees through recognition of their constructive thinking has meant much in improving the quality and quantity of petroleum products. Still greater results are anticipated from the extended Plan.
PERSONALITIES IN THE NEWS

Franklin T. Britney Retires
Frank Britney, who received his 40-year service button in April, retired on May 1st. He was born near Petrolia, Ontario, and received his schooling there. Mr. Britney's 40 years of continuous service with the Company started in 1907 at the Sarnia refinery. In 1911 he left Sarnia for the West where he was engaged for the next two years in the construction of many of the Company's bulk plants. He transferred to the marketing department in 1933 and was stationed in Alberta. In 1919 he was moved to Fernie, B.C. where he was located at the time of his retirement.

Herbert Lane Receives 40-Year Button Prior to Retirement
Herbert Lane, who retired in June as chief accountant of the building administration department of the executive office, was presented with his 40-year service button at a dinner in his honor at Toronto. Director A. E. Halveson made the presentation.

Born in Toronto, Mr. Lane joined Imperial's Ontario marketing division in 1907 where he became assistant chief accountant. In 1941 when the building administration department was set up at the executive offices, he left Ontario division to become chief accountant of the new department. His chief hobby is cabinet making to which he will devote still further time now that he has retired under the Company's pension plan.

Lewis Johnson Retires
After 23 years as a porter with the executive office in Toronto, Lewis Johnson retired this spring. At a gathering in the board room on the 8th floor where he has worked for the past two decades, "Lewie" was presented with a Dominion of Canada bond and received the best wishes of the directors. "Lewie" was born in Toronto, and before joining the Company in 1916 he worked at a variety of jobs including that of pullman porter on the old Grand Trunk Railroad. In years past he was an enthusiastic baseball player in the Toronto Industrial League, and played shortstop on a championship team for two years in succession.

C.I.C. CONVENTION

New chemical developments in various national activities ranging from agriculture to nuclear chemistry were discussed by representatives from all parts of Canada attending the annual conference of the Chemical Institute of Canada at Banff, Alberta, June 8 to June 11.

Dr. Paul E. Gagnon was elected president; T. W. Smith, vice-president; Dr. Leon Lorle re-elected chairman of the board.

A section of the program was devoted to the chemistry of petroleum. Dr. O. B. Hopkins, a vice-president of Imperial Oil Ltd., spoke on the "Oil and Gas Resources of Alberta and Their Utilization". Dr. C. H. Caezar, supervisor of Imperial's research in fuel technology, described the suspended catalyst cracking process which has been developed extensively at Imperial's Sarnia refinery to obtain high octane gasoline and cracked gases.

H. R. Holland of Sarnia's inspection laboratory, who is secretary of the C.I.C. division of chemical education, discussed problems of Canadian teachers of science. E. B. Luseby, chief chemist at Sarnia, who is treasurer and a director of the C.I.C., presented the Institute's annual financial statement.

Imperial established an exhibit at the convention which portrayed the laboratory facilities required by an oil company for the analysis of material from the producing fields. The Company also arranged tours for Institute members through the Turner Valley oil field and the Imperial refinery at Calgary.
A field man checks the flow of gas separated from the crude oil at No. 3 well in the new Leduc producing area.