THE EDITORS SAY:

CHRISTMAS and the New Year are near at hand in a world that is largely unable to enjoy the true spirit of these two great feasts. Yet, even above the clamour of war, greetings of good will will ring out and hope lives on that the dire events of the present are bringing nearer the day when the simple teachings of the Prince of Peace will at last prevail.

To all Review readers and to Company employees the officers and directors of Imperial Oil Limited join in expressing their Christmas greetings and good wishes for the New Year.

** ** **

AT THE TIME this issue of the Imperial Oil Review goes to press the names of 64 employees who have volunteered and been accepted for active service have been received. Their sacrifices may be no greater than necessary the Company is protecting their service status and has arranged that they may continue their participation in the various benefit plans. Also the Company will see that financial sacrifice is not entailed by paying to each volunteer the difference between his way of duty and the amount which he receives in the service of his country.

** ** **

AS A GAS FIELD Turner Valley is more than 25 years old, as an oil field it is still an infant but a lusty, well-nourished and promising one. Sometimes pictures have been painted of a development retarded by lack of reserves or aggressive action but they do not bear close scrutiny. The development has been orderly and at a rate approximately equal to the increase in demand and it is the application of sound economic principles and a high degree of planning which has contributed to the success of the field.

Announced is the construction of a new refinery at Edmonton, which will have a capacity of 5,000 tons per day. The announcement was made by D. D. McPhail, Vice-President of Imperial Oil Limited, which is published to this come from the transcript of the evidence.

** ** **

GASOLINE'S remarkably low price (from the viewpoint of the consumer) is graphically illustrated on pages 6 and 7. When looking at the charts it should be borne in mind that not only is the price relatively lower than prices of other important commodities but also that through the years as prices declined quality steadily improved. The industry's own efforts in technological development made such progress possible.
All Permanent Employees in Canada of Imperial Oil, Limited and its Domestic Affiliates.

The policy of Imperial Oil, Limited regarding permanent employees who enter the service of His Majesty's Forces is as follows:

1. Service status of employees will continue during period of active service.

2. Enlisted employees reporting to the Company will be re-employed after completion of services with His Majesty's Forces.

3. The Company will pay each enlisted employee an amount equal to the difference between the salary or wages he receives from the company and the pay and allowances received by him from His Majesty's Forces, less the employee's regular monthly deduction for Group Insurance and Employee Thrift Plan.

In cases where the remuneration from His Majesty's Forces equals or exceeds the remuneration earned by the employee before enlistment, the employee can remit to the Treasurer, Imperial Oil, Limited, Sarnia, a sum to cover premiums on Group Insurance and participation in Employees Thrift Plan, on the basis in effect at the time of entering His Majesty's Forces.

In case an enlisted employee is unable to maintain his regular scale of contribution to the Thrift Plan during period of military service, the amount may be reduced to the minimum of 3%.

4. Replacement of enlisted employees: Parties entering the employ of Imperial Oil, Limited during period of hostilities are to be considered temporary employees.

5. The Company reserves the right to revise this policy in any respect as it may pertain to employees enlisting on and after March 1, 1940.

Yours very truly,

[Signature]

November 1, 1939.

By W. A. ROLIFF, Geologist, Imperial Oil Limited

Search for Oil in Gaspé

Although Neglected During the Last Quarter of a Century, the Gaspé Peninsula Is Again Being Tested For Oil.

AFTER A LAPSE of a quarter of a century, interest has again been revived in the petroleum possibilities of one of the oldest parts of Canada, near the shores where, in 1534, Jacques Cartier landed and claimed the country for his sovereign, the King of France. About thirty miles west of the town of Gaspé, La Compagnie d'Exploration de Gaspé Limitée has commenced a well to test the possibilities of a region now almost forgotten by those in the petroleum industry.

Indications of oil were known in Gaspé as early as 1836 and in Sir William Logan's Report for 1844 reference is made to the bituminous matter at Tar Point and to seepages on the beach near Douglastown and on Silver Brook. These occurrences, and many others known to the inhabitants of the district, stimulated a desire to find some use for the material. In 1896 Count de Rottemund made some suggestions in this respect, but it was not until after the discovery of petroleum in Pennsylvania in 1859 that serious attention was directed to the Gaspé occurrences.

The first attempt to locate oil in the Gaspé Peninsula was made in 1860. Two wells were drilled but they yielded only traces of oil. Attention was again drawn to the Gaspé in 1865 when a more complete description of the region was contained in the report of the Geographical Survey of Canada. The revival of interest brought about the drilling of a well known as the Conant or Adams well which produced a small quantity of dark oil and which continues to yield a similar product today.

Since that time a total of 58 wells have been drilled in the region and, while many of the wells were dry or
yielded only salt water and a limited supply of gas, so that produced enough oil to encourage the laying of pipes and the erection of a refinery. The refinery was built in 1900-1901 and consisted of two stills of 150 barrel capacity each, with a series of tanks and the necessary pumps and engines with a central tank of 2,500 barrel size. The refinery had a capacity of between 8,000 and 9,000 barrels per year and was connected with the region by about 15 miles of two-inch pipe.

The optimism of those early days seemed hardly justified since it has been estimated that the total oil yielded during the years 1901 and 1902 was only 255 barrels of oil with a range of quantities lost by fire and other causes. Operations ceased entirely at the close of 1902, and shortly afterwards the company (The Canada Petroleum Company) went into liquidation. In 1903 a sheriff's sale was held in London, and the company's properties were sold.

About eight years later another attempt was made, and a single well was drilled near the north side of the Mackenzie River. No greater success attended this venture than had rewarded earlier attempts and no further operations have been undertaken to the present date. Though oil was obtained in many of the wells, and still flows in small quantities from some of them, results to date have been anything but encouraging.

It has for some time been a question in the minds of the geologists familiar with the Gaspé region as to the possibilities of this area, which exhibits many indications of the presence of oil, and had been conclusively tested by the drilling done towards the end of the last century. At the time of these early operations little was known of the conditions under which oil is usually found and furthermore the geological work in this section had all been of a general or reconnaissance nature. With the principal aim of determining whether geological conditions warranted renewed attempts by drilling to find petroleum in commercial quantities, geologists of the Quebec Bureau of Mines have during the past few years re-studied and mapped in detail the geology of a large area surrounding the scene of former activity.

As a result of these studies, carried on under the direction of Dr. J. W. Jones, it is believed that very few of the wells drilled were suitably located with respect to structure considered to be most favorable for oil accumulation and that few that were drilled ever reached a depth sufficient to provide an adequate test of the petroleumiferous rocks in the area.

Consequently it has been decided again to attempt a search for oil in the Gaspé region.

Before drilling could be commenced, it was necessary to construct 51/2 miles of road through virgin forest, erect camps to house the drilling crew, and haul in and erect the necessary drilling plant which consisted of over 150 tons of machinery and equipment. All of this was accomplished between August 6th and October 26th, and shortly after midnight on this latter date drilling was commenced.

A crew of 12 men is employed on this operation under W. R. McMaster, drilling superintendent of the company, and includes drillers with experience from the tropics to the Arctic Circle. The well is being drilled with a cable-tool outfit equipped with a powerful up-to-date diesel driving engine and was commenced with a 20 inch hole. Drilling will be continued on into the winter as long as weather conditions permit.
The charts on these pages compare price trends of gasoline with other important commodities on the 1926 price basis. It will be noted that while the general trend of commodity prices turned upward in 1932, the price of gasoline continued to decline, and now stands at an all-time low of 59.4% of the 1926 price level. All the charts are based on figures published by the Dominion Bureau of Statistics, Ottawa.

FARM PRODUCTS: It will be noted that while the price of gasoline did not fall as sharply from 1929 to 1932 as did farm product prices, the downward trend of gasoline has been consistent and the price has been on a lower level than farm product prices almost continuously since 1935.

FOODS, BEVERAGES AND TOBACCO: Food prices moved somewhat erratically during the years from 1929, reaching a peak of 61.3% of the 1926 level in 1932 and then rising fairly steeply until 1937 but losing ground in 1938. In September they reflected war conditions but the price of gasoline at its all-time low.

COST OF LIVING: The cost of living declined from 1930 to 1933 but the price of gasoline was on a steep downward trend in 1927 and with the exception of 1932 continued this trend until 1938 when the price levelled out. Latest figures show the cost of living at 82.4% and gasoline at 59.4% of the 1926 levels.

BUILDING AND CONSTRUCTION MATERIALS: The building and construction trades have been depressed for some years and this condition reflected in low prices for building and construction materials. But their index never fell as low as the gasoline index and recovered between 1933 and 1937 and again late this year while gasoline continued at 59.4.

CLOTHING, BOOTS, ETC.: Costs of clothing, boots and undergarments moved downward almost consistently from 1928 although not so steeply or quite so consistently as the price of gasoline. The effect of war is revealed by the upward trend of prices for clothing, boots and undergarments in September last.

HOUSEHOLD EQUIPMENT AND SUPPLIES: Prices of household equipment and supplies fell between 1926 and 1933 and remained fairly level thereafter, gaining somewhat between 1936 and 1938 and declining from 78.9 to 76.1 between January and August of this year. Then in September they rose again to 77.4 as a result of war conditions.

MANUFACTURERS' MATERIALS: Prices of manufacturers' materials fell between 1926 and 1932, rose between 1932 and 1937, dropped sharply in 1938 and 1939 and made a fair recovery in recent months, being in September at 68.4% of the 1926 level as compared with 61.3% in January last. Gasoline was at 60.6% in January and 59.4% in September.

ALL COMMODITIES: The "All Commodity" index reversed its downward trend in 1933 as we climbed out of the pit of the great depression and in September last stood at 78.2% of the 1926 level which is 11.5 points higher than the 1932 low; but gasoline at 59.4 was 13.6 points lower than in 1932.
COLOMBIA'S

Buried Trade Route

• Andian National Pipeline Has Transported More Than Two Hundred Million Barrels of Oil To Tidewater in the Past 13½ Years.

Photo Blank and Stoller.

FOLLOWING the Andian pipeline through the jungles of Colombia in a launch on the Magdalena River, walking through the spotless pump stations and realizing that over 50,000 barrels of El Centro crude daily flow through the line it is difficult to picture the negotiation, organization work, preliminary surveys and actual construction necessary to the present smooth functioning of this great service. For all its 335 miles no oil is in sight; pump stations are spotless within and beautiful in their setting of tropical gardens; unhindered but competent Colombian and North American workmen move above the stations. Occasionally the company's hydroplane lights on the river carrying one of the two doctors constantly patrolling the line to maintain a rigid standard of health; or one of the big stern-wheel river boats reminiscent of the Mississippi in the last century glides swiftly down stream or bucks the seven mile an hour current upstream with automobiles, cattle and equipment for the interior. The whole impression is one of quiet unheeded efficiency in the performance of a tremendously important job.

Reprinted by Permission from "World Petroleum".

COLOMBIA'S

Buried Trade Route

• Andian National Pipeline Has Transported More Than Two Hundred Million Barrels of Oil To Tidewater in the Past 13½ Years.

Photo Blank and Stoller.

One concludes very soon that this industrial efficiency in the steaming jungle valley must be the expression of an extraordinary character. One's conclusion is justified by the reputation of a name that is apparently as familiar in forgotten fincas along the river as it is in Bogota, Toronto, or New York.

In 1919 Captain J. W. Flanagan arrived in Bogota after a tedious 15 day trip up the Magdalena by river boat and a mule-back journey to the eight thousand foot elevation of the Bogota savannah. He had started negotiations with the Colombian government for the construction and operation of a pipeline from the jungle field of El Centro to the ancient port of Cartagena. Down in the valley surveys were being carried out under his direction while in the beautiful capital, Captain Flanagan met almost daily with government representatives. Deliberately, these able men considered every aspect of the proposed project. Finally in October 1923 the contract was executed under which the line was built and is operating today. Studies and surveys in the valley were pushed forward with renewed vigor and in January 1925 the initial pipe order was placed.

Captain Flanagan was acting on behalf of the Andian National Corporation, Ltd., organized in Canada with a Dominion charter in 1919. It derived its resources from the sale of shares to Canadian, British, United States, and Colombian interests; Captain Flanagan, as president, handled the negotiations, actively supervised the construction, and directed the policy of the company from its inception to the present day. When he is not flying to Bogota, working in New York or studying operating reports in Cartagena, the Captain is to be found atop the tallow building in the British Empire in Toronto directing the policies of his company and planning his further industrial and philanthropic activities covering two continents.

Operations of the company are in such competent hands as those of L. P. Maier, vice-president who as engineer participated in the surveys and construction, and H. A. Burgen, secretary-treasurer. In Bogota the company is ably represented by R. I. Dodson and his assistant, H. B. Richardson and is managed from Cartagena by J. K. Rose and P. C. Schiffer. The pipeline superintendent is E. L. Shum and P. S. Kleinman is in charge of station operation.

Construction of the line was accomplished in the remarkably short time of 13 months from laying of the first joint on April 1, 1925, to completion on March 6, 1926. This was six months earlier than even the most optimistic estimates. It included the construction of 10 pump stations, laying 335 miles of 10 inch line and the installation of a metallic circuit telephonic system paralleling a pipeline.

Government officials made their inspection and gave the line official authorization on May 27th, 1926. The transportation of oil was immediately inaugurated. This original construction provided a carrying capacity of about 80,000 barrels of crude oil per day. Including station pumping equipment, 60,000 tons of material went into the construction of the line, all of which was handled through Port of Cartagena, thence by rail.
to Calamar, where it was loaded on river steamers for distribution at various points along the pipeline. During the construction period there were about 3,000 Columbians and 250 North Americans employed. The difficulties encountered both in the original surveys and construction can be readily appreciated, as no roads existed, the line itself being located mainly through treeless jungle. Transportation difficulties were enormous, and labor at that time, while extremely willing, was entirely inexperienced. Health conditions might well have been bad, especially in the wet seasons, as the annual rainfall is approximately 120 inches per year.

During the construction period with Captain Flanagan actively in charge, engineers and workmen were housed in large screened hoochies mounted on steel borges which could be moved along the river as the work progressed. Despite the dampness and heat of the valley the efforts to maintain the health of the workmen were rewarded by the fact that not a single life was lost as a result of malaria or dysentery.

Great stem river steamers of remarkably shallow draft conveyed thousands of tons of equipment to points on the river bank and from these unloading points material was distributed up and down the river on two-wheeled carriages over crude roads hacked through the jungle. Some mechanical ditches were used but a large part of this work had to be done by hand due to the swampy conditions and dense jungle growth. At that time welding had not reached its present highly efficient point, so screwed joints were used. All subsequent repairs have, however, been welded and a certain amount of this work is carried out every year due to the highly corrosive nature of the soil through which the line passes. Originally the line was treated with asphaltic emulsion but frequently retreatment has been necessary.

Almost immediately upon completion of the first line, it was decided that additional carrying capacity was required, and two hundred and eighty miles of 10 inch loops were laid, increasing the potential through-put from 30,000 to slightly more than 50,000 barrels per day. This additional work was completed in 1927. In 1937 a further small increase was needed, which was secured by the construction of about 20 miles of 12 inch loops, increasing the through-put for the type of oil now being handled to approximately 52,500 barrels per day.

Sixteen miles inland from Barranca Bermoja on the river is the El Centro field producing from two important structures—the Infantas and La Gira. Field oil is run to storage in three 80,000 barrel and three 55,000 barrel tanks and thence to the 10 inch line originally laid from the field to the river port. Subsequently a four mile 10 inch loop was installed increasing the capacity of the line. Four 200 h.p. Diesel engines, direct connected to four duplex pumps start the crude on its way to tidewater. The next pump station is at Galan a few miles down river from Barranca Bermoja. This station is equipped with three 500 h.p. Diesels and three triplec pumps. Two 60,000 barrel tanks are available here. The line is looped the entire distance of 15 miles to the next station at Chingale making parallel 10 inch lines. It crosses the Rio Soromoso within a few miles of the Galan station.

Chingale is the first typical jungle pump station having two 500 h.p. Diesels direct connected to two triple pumps. There are an additional two 200 h.p. Diesels direct connected to two smaller duplex pumps. Both the 200 h.p. Diesels or either of the 500 h.p. Diesels can be cut out any time for repairs or reconditioning. The engines take fuel direct from the line. Two 30,000 barrel tanks furnish storage capacity here as at all river pump stations. The station is equipped with generators, ice plant and domestic water systems providing for chlorination of the water. There are separate office buildings, a well-stocked warehouse, separate residences for families and bachelor quarters as well as mess halls. All buildings are double screened and the grounds are planted with tropical trees and foliage, lawns between the buildings being beautifully kept up. First aid equipment is available and in case of serious sickness the patient can be transported to the well equipped hospital at Mamanal in a few hours by company plane.

Chingale station is described in detail because the same equipment and facilities are maintained at all the other stations down the line until one reaches Barranca Nueva station when the line leaves the river and starts across country to Cartagena and Mamanal.

Proceeding downstream (north) from Chingale the line is some distance in from the river and for three and a half miles consists of 10 inch single line where crude is traveling under 500 to 600 lbs. pressure. The first loop of 12 inch occurs at the 35/2 miles point and continues for almost three miles further. From there two 10 inch lines carry the oil under reduced pressure to the Puerto Mosquito station located a few miles in from the river. The distance from Chingale to Mosquito is 35 miles and the line crosses the Rio Liebre. A similar system of loops carries the line 36 miles further down stream to Centilla although on this stretch the line crosses no major river.

Following the bend in the Magdalena the pipeline, looped as outlined above, crosses the Rio Costa near the town of El Banco. Here the Magdalena splits to form the Island of Mompas and a few miles down the east branch is located the Los Negroes pump station. All the major river traffic now follows the west branch of the river but boats and supplies can be sent down the east branch when necessary.

Forty miles further down the east branch is located the Santa Ana station. Another forty-one miles brings one to the Plato station. Three and a half miles below Plato the line crosses the Magdalena and reaches the Barranca Nueva station located within a few miles of Calamar. The Barranca Nueva station carries the same equipment as that at Galan and marks the point where the line (Continued on page 30).
PROGRESS OF FLIGHT

- Slow At the Beginning, Aviation Has Blazed New Pathways In Recent Years

EVER SINCE man was first created he has had an inquisitive desire to soar above the earth. Yet, despite this longing, it is only comparatively recently—1783 to be exact—that man first surmounted above the earth.

Man's efforts, however, go back many centuries before that time. Greek mythology records the escape from Crete of Daedalus and Icarus by means of home-made wings. Daedalus, builder of the famous Labyrinth, enjoined Icarus not to fly too low, lest the wings dip in the sea and the glue that held them together be softened, nor too high, lest the heat of the sun have the same effect. Icarus disobeyed, sought too lofty a flight, and fell headlong into that part of the Mediterranean which since that day has been known as the Icarian Sea. The more cautious Daedalus, the story reports, flew safely to Sicily where he was given protection.

Though the majority of early flying machines never left the ground they are of no little historical interest. Leonardo da Vinci, the great Italian painter and sculptor, was also a gifted engineer and mechanician and his interest in aviation was aroused during the latter part of the 15th century. Though not a great deal is known of Leonardo's aviation experiments, experts aver that, had he had at his disposal some source of power such as the steam or internal combustion engine he would have achieved flight.

Typical of the "paper" machines is Lamy's Flying Machine (1) which is shown above. Designed as early as 1670, it was never constructed. The wooden hull was to be suspended from four large copper balls from which the air was to be exhausted, it being thought that the structure would then weigh less than the surrounding air and would consequently rise. Motive power was to be supplied by the sail.

The title of "World's First Aeronaut" is generally conferred on Pilatre de Rozier, who, in 1783, flew the balloon shown in (2) over Paris. Built by Joseph and Etienne Montgolfier, it was a "hot-air" balloon with a fire maintained in a brazier below the neck of the balloon. For use in the event of the fabric catching fire, water and a sponge were carried.

Of considerable interest is the Navigable Balloon (Continued on page 14)

250 YEARS OF AVIATION DEVELOPMENT

HOW TURNER VALLEY DEVELOPED AS AN OIL FIELD

EVIDENCE OF B. V. LE SNEUR, K.C., Vice-President of Imperial Oil Limited, Before the Alberta Royal Commission on Petroleum and Petroleum Products, October 21, 1939.

WHEN THE Turner Valley Royalties, the first large crude oil producer, was brought in and there appeared to be a good possibility that Turner Valley would become a crude oil field, we adopted the policy of utilizing demand for petroleum products to encourage development, both from the national aspect as developing a Canadian year, and in the Federal and with the objective of determining if possible a crude oil supply which would be convenient and advantageous for the provincial producers. Conversely our policy was to use every endeavour to have that development proceed in an orderly manner and to avoid and escape the chaotic and thrusting conditions which the producers in nearly all new fields undergo in quoting some crude from its established market and quoting that market either partially or wholly for the new crude.

Now the first step and a fundamental step in pursuing this policy was to agree with the Turner Valley crude producers an assured and a steady market that was essential for development and that meant development in the early days when the production was small, through our Calgary Refinery, offered a market for all the Turner Valley crude which was seeking a market and as the production increased we correspondingly and proportionately increased our purchases of Montana crude, for example it may be worth noting that in January of 1937 our average purchases of Turner Valley crude was 478 barrels per day and by December of 1937 our takings averaged daily 3,547 barrels. Then as the production in Turner Valley increased we were faced with an endeavor to expand the market for Turner Valley crude to the Edmonton and the Regina territory. We were faced with a very serious handicap in the freight rates, and if those freight rates could not be reduced it meant a very material reduction in the price of Turner Valley crude and we felt that our assurance to the producers in maintaining a steady process and development it would not stand a severe setback such as would be caused by a reduction in price for we must realize that price is one of the fundamentals in securing a reasonably rapid development. We therefore approached the railway companies and after rather protracted negotiations and by assuring and a more modest freight charge that a reasonable and an equal charge for a daily similar pipeline shipment we were fortunate in getting a material reduction in the freight rates. We believe the reduction was from 76 cents a barrel to about 53.2 cents a barrel for shipment from Calgary to Regina.

When that reduction was obtained, which was about the beginning of heavy freight charges previously incurred to move the product in from the Ioco Refinery near Vancouver.

Keenly interested in northland developments is Hon. T. D. Pattullo, Prime Minister of British Columbia, who was a recent visitor of Fort Norman and who lunched at the plant one day when construction work on the new unit was at its height. The IMPERIAL OIL REVIEW is indebted to Mr. B. Hetherington, the Prime Minister's secretary, for the photographs reproduced on this page.

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Evidence of B. V. Le Sneur, K.C., Vice-President of Imperial Oil Limited, Before the Alberta Royal Commission on Petroleum and Petroleum Products, October 21, 1939.
The price of crude oil in Turner Valley is not an isolated fact: it is related to crude oil in various other parts of the world... The posted field price must represent a sound judgment of a situation... There is no mystery about field price. You buy at the lowest price consistent with quality, transportation and supply... As there is more crude in Turner Valley than can be absorbed by the refineries in the vicinity it is necessary to consider what price it will command in foreign markets. The price of crude oil from that field can be projected to a point at which it will be in competition with crude oil produced in other parts of North America.

---from the evidence of Dr. J. W. Frey, Associate Director, Petroleum Conservation Division, Department of Mines, Washington, U.S.A., an expert witness called by the Alberta Royal Commission on Petroleum and Petroleum Products.

The judgment used in arriving at a fair and equitable price for crude is essentially the judgment as to whether the crude could be purchased at the lowest price, taking into consideration transportation, tariffs, yields and other factors that determine the value of crude... Price arrived at on the basis of that judgment puts that crude in dynamic equilibrium with other crudes with which it is in competition and thereby in equilibrium with all the crudes throughout the world... The other crude that might be used in place of Turner Valley crude is Montana crude... By the use of certain postulated price, appears to put Turner Valley crude in dynamic equilibrium with Cutbank (Montana) crude at Regina.

---from the evidence of Dr. G. Granger Brown, Consulting Engineer and Professor of Chemical Engineering University of Michigan, an expert witness called by the Alberta Royal Commission on Petroleum and Petroleum Products.
Late Wm. J. Gilchrist

Former Superintendent of Sarnia Refinery Worked His Way Up from An Accountant.

Sarnia lost one of its best known citizens in the death of William J. Gilchrist, a former superintendent of the Sarnia refinery of Imperial Oil Limited, at his home on October 30th. He was 75 years of age.

The late Mr. Gilchrist had been a resident of Sarnia for 40 years and had enjoyed the respect and esteem of all who knew him. He came to Sarnia when the refinery was built and was highly regarded for his ability, his personal way and his unfailing fairness and kindness to all his subordinates.

The late Mr. Gilchrist retired on December 22, 1922. His superintendency included the period of the Great War when what is believed to have been the first major test of the output of the refinery was exacted in order to meet war requirements for its products.

Mr. Gilchrist came from Buffalo, N.Y., in 1899 with H. B. Chamberlain who laid out the Sarnia plant. He worked his way up from accountant to head of the refinery, becoming superintendent in 1916.

Mr. Gilchrist retired under the Company’s pension plan in December 1922 at the early age of 56, and as a result was able to enjoy many years of leisure before his death. In the summer he enjoyed a round of golf and was a past president of the Sarnia Golf Club.

He was a member of the Sarnia Curling Club and an enthusiastic supporter of all forms of athletics including the Imperial Oil employees’ football team.

At one time Mr. Gilchrist was also an active curler

Berranca-Bemeda Opens Golf Club

Built by Tropical Oil Company and turned over to the employees for their recreation and benefit, the new Lake Miramar Golf Club at Berranca-Bemeda, Colombia, South America, is an important centre of social activity.

The club house is of ultra-modern design, constructed of steel and concrete and provides facilities for dancing and other social activities.

Full responsibility for the maintenance and operation of the new club has been assumed by the employees, and privileges are being extended to Colombian officials who enjoy the game. The president of the club is Mr. P. M. Newman, Assistant Refinery Engineer, at Berranca-Bemeda.

Sport plays an important part in the health and recreation of employees in the tropics where the weather is conducive to outdoor activity. In addition to golf, fishing and swimming are especially popular. Softball is obtaining wide popularity among organized games. Soccer, for years one of the main sports, has been taken up by the native population, following its introduction into Colombia by Tropical Oil employees.

The late William J. Gilchrist and in 1905 won the Mackenzie medal emblematic of the singles championship of the Sarnia Curling Club. The medal was donated in 1878 by Hon. Alexander Mackenzie and is one of the oldest curling trophies in Canada.

Mr. Gilchrist was succeeded by his wife, Anna, in 1927. Surviving are his daughter, Mrs. E. J. Higgins of Sarnia, his son, W. C. Gilchrist, a director of Cockfield, Brown & Company advertising agency, Toronto, and two sisters, Mrs. Sarah Ball and Mrs. Mary Welch, both of Buffalo, to whom the Review joins in extending the sympathy of all employees.
Draining operations began east of Talara village im-
mediately the February rains stopped.

Peruvian quarters resembled Venice during the spring
of 1932 following the rain.

Through the rain of 1932 flooded through Talara village
little damage resulted.

The rain of 1932 was so heavy that lakes like the above
appeared in the desert overnight.

Every Few Years Torren-
tial Rains Flood the Peru-
vian Countryside, Adding
to the Oilman’s Problems

THREE FLOODS have been experienced by Inter-
national Petroleum Company Ltd., since entering Peru.
The first flood, in 1923, did considerable property
damage and operations were disrupted for several
months. Profiting by this experience, changes were
made in the location of important equipment, principal
of which was the fresh water pumping plant which
had been destroyed. The second flood, in 1932, caused
little damage, due mainly to the precautions which had
been based on the experience of 1923; and the flood in
February of this year likewise did not seriously hinder
operations.

The periodic rains of Peru, while usually occuring
every seven years, are by no means regular; for rain
did not fall in heavy quantities from 1891 until 1925.
Previously to 1891, when the entire country was dis-
astrously flooded, rains had occurred in 1857, 1866,
1871, 1872, and 1884. The rains are known as 'years of
abundance' since the desert is soaked by the heavy
downpours and within a few weeks is covered with
abundant pasture.

In 1925 rains began on January 19 and continued for
sixty days; the Chira River cut itself a new channel
and as a result of the continuous downpour the com-
pany spent over $850,000 to make repairs.

The fresh water pumping station was destroyed
during the first month of the rain and was not operat-
ing for nine months. This was the most serious loss,
for the 16,500 persons in Talara and Negritos were
dependent upon the fresh water supplied by the com-
pany. In 1925, as a result of the flood, only 41,900,000
gallons of water were pumped, as compared with 141,-
000,000 gallons in the previous year. The emergency was
met by pressing the SS IOCOMA, a tanker, into serv-
ice as a water carrier between Callao and Talara, a
distance of 528 miles.

The safety precautions taken after 1925 have been
effective, for the rains of 1932 and of February this year
casted very little damage. In 1932 the damage was
so slight that no mention was made of the rains in the
annual report of Talara operations. This year, while
water covered the entire field, transportation and drilling
operations were continued without interruption.
SPEARHEAD OF THE PETROLEUM INDUSTRY

The early settlers in this country were necessarily industrialists on a small scale. They knew that crops could not be raised in forests. It was obvious to them that the ground had to be cleared and the soil carefully prepared before seed could be sown and any crops obtained. Success or failure largely depended upon how well these tasks were carried out.

Progress in industry is akin to that of the settler. It is only made by clearing the ground and preparing the soil, in order that crops which are visualized as potential may be raised.

An attempt will be made in this short article to describe the clearing and preparation which has taken place in the field of petroleum, in order to provide for human wants.

Perhaps no industry in history has witnessed such a startling evolution in such a short time as that of petroleum. Some industries in their infancy have been fortunate enough to step into a field which has already been cleared and prepared. This was not the case with petroleum, however, and the tremendous strides which have been made in the past twenty or thirty years must be attributed to the amazing amount of research work which has been carried out by the geologist, geophysicist, engineer and chemist.

Although investigations relative to the nature of petroleum had been going on for some time, it was not until a little more than twenty years ago that the petroleum industry itself began to seriously consider the chemical constitution of its raw material.

Crude oils consist mainly of mixtures of compounds known as hydrocarbons. These compounds are combinations of hydrogen and carbon, two of the commonest and most plentiful elements in the universe. The characteristics of any given product obtained from petroleum, whether it be gasoline, kerosene or other products, depend upon the kind and number of hydrocarbons which exist in the mixture.

Due to the fact that there are hundreds of different hydrocarbons, containing varying numbers of carbon and hydrogen atoms, many different forms of each of these hydrocarbons exist. There are known as isomeric forms, and the individual compounds are called isomers.

Some idea of the complexity of hydrocarbon chemistry may be obtained from the following table, which shows the possible number of isomers corresponding to each individual hydrocarbon:

<table>
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<th>Number of Carbon Atoms in the Molecule</th>
<th>Number of Isomers</th>
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Thus it will be seen that one molecule in a lubricating oil, for instance, consisting of 25 carbon atoms and 52 hydrogen atoms, may exist in almost 37,000,000 combinations. This astonishing figure applies to only one type of molecule containing 25 carbon atoms. More millions of variations are obtained when 25 carbon atoms are united with 50, 48 or 46 hydrogen atoms.

It is evident from the complexities outlined above, that the wresting from Nature of knowledge of the chemical constitution of petroleum is a gigantic task.

Therefore, it is evident that the control and economy of the processes used for producing the various fractions (gases, gasoline, fuel oil and lubricants) is the primary business of the industry at the present time.

Fundamental and applied research are the tools which have been used, and which are necessary to carry on the petroleum industry of to-day, to obtain the information vital to progress. Fundamental research includes the investigation of the chemical constituents of petroleum and the determination of the chemical, thermodynamic and kinetic constants of hydrocarbons and their derivatives.

Applied research is concerned with the development of practical commercial methods for effecting the separation of desired hydrocarbons, and the investigation of various chemical reactions involving petroleum hydrocarbons and their derivatives.

As a result of fundamental research, many individual hydrocarbons have been isolated by laborious fractional distillation and crystallization methods, and their characteristics are now well known. However, since the number of combinations is so large, much work has been extended beyond the components of gasoline and gasolene. This information, nevertheless, has enabled applied research to improve the characteristics of the products of the petroleum industry tremendously, and to convert petroleum fractions into products hitherto unthought of, such as synthetic alcohols, resins and even fertilizers.

In order to make the results of such intensive labor best cost, it has been necessary for petroleum research to co-operate very closely with hundreds of other industries. The necessity for this is obvious, when one considers, for example, the ramifications of present-day transport, whether it be by land, air or sea. Fuels, lubricants, road construction materials and dozens of other products of the petroleum industry have an important part in this connection.

Until quite recently the bulk of petroleum refining has consisted of turning out multiple products derived from the separation and recombination of hydrocarbons. Such processes have not been responsible for any change in the physical or chemical attributes of the components themselves. However, the industry is rapidly entering another new and more fascinating field: the production of materials which do not occur in petroleum, but which are obtained by a chemical transformation of its components.

Thus in research is being called upon to perform new duties. It has had time to obtain little more than a smattering of information regarding its new material. To quote the words of an eminent ambassador of science, this task is left to "those having the simplicity to wonder, the ability to question, the power to generalize, the capacity to apply. It is, in short, the company of thinkers, workers, experimenters and practitioners upon which the world is absolutely dependent for the preservation and advancement of that organized knowledge which we call science.

It is they who bring the power and the founts of knowledge to the multitude who are content to go through life without thinking and without questioning, who accept fire and the hatching of an egg, the attraction of a feather by a bit of amber, and the stars in their courses as a fish accepts the ocean."
WE HAD WARNINGS that the weather would not be all that it should be before the big Boeing lifted off the wind-ruffled water at Port Washington and slowly swung her nose northeasterly.

The forecasters, who occasionally distribute their favors with grading hands, refused to give us clear sailing as far as Batwood, Newfoundland, let alone over the Atlantic; on this, the first commercial flight by Pan American Airways over the "northern" airway to Europe, but neither passengers nor crew were inordinately concerned. Our Brian are brought up in the tradition that a man who knows his business can spin it to the teeth of a sixty-mile gale without soiling his uniform. Moreover, it was too pleasant to get shot, above the heat which clung lethargic to the seaward, to worry about weather.

I had flown the "southern" airway, by way of the Azores and Lisbon to Marseilles. I had looked down on the brilliant greens and yellows of those tiny Portuguese islands which resemble a Hollywood director's picture of what islands should be, and had enjoyed the magnificent hospitality of the city where the Clippers make their European landfall and of the other city which is their terminus. This was my first opportunity to compare the two routes.

There were seventeen passengers aboard for the inaugural flight. The takeoff was easy. The Yankee Clipper slipped her leashes and taxied out to a lane of water cleared of traffic by port attendants. Skipper Field E. Gray, chief pilot of the Atlantic Division, satisfied himself that the throtts of his four 1,500 horse power Wrights were free of clogged. Then the throttles were opened, the ship lifted to her step and in a matter of seconds the 155-foot wing was putting distance between us and the water.

To landhoppers who never have flown through "cloud country" while the sun shines down on one of nature's most majestic spectacles from far horizon to far horizon, that trip to Shetland, New Brunswick, would have been a revelation. To the crew of the Yankee Clipper, one of the four, forty-two ton winged boats which Pan American Airways operates to Europe, I suppose the sight was routine. On the bridge above the passenger deck the captain and his aids worked out their navigation and engineering problems with the ease which comes from long practice. But to those of us who lounged in the spacious passenger quarters or took a "turn around the deck" to stretch our legs by roaming from stern to stem of the big craft, the flight was like opening a constant succession of Christmas packages from a rich and prodigal aunt.

For two hours we flew "on top." For the last hour of the five-hour trip we were under clouds, cruising over what seemed thousands of Canada's lakes. It was a lesson in geography. The coastline was scalloped, as though it had been cut with a dressmaker's shears. By the time we reached Shetland, we had had good-bye to the sun and the chill of a coastal Canada July made those of us without coats look with new appreciation on the two of our seventeen passengers who had been nice enough to lug theirs along.

I don't suppose the name Shetland meant much in the atlases until trans-Atlantic air service was established. The airplane is doing that for out-of-the-way places all over the globe. This village has an inviting harbor and a populace which comes down to meet the Clipper just as the residents of small towns in the United States gather of an evening to meet the train. One of their chief industries is lobster fishing. A few miles away is the community of Monson, eastern terminus for Trans-Canada Air Lines. To my unpracticed eye the architecture of Shetland looks old English more than anything else. Its people are of the proverbial scalloping type, with tanned and friendly comenians which know the bite of roaring nor'easters.

The publisher of the local newspaper, the mayor and other officials were at the dock to welcome us. So was some news of the weather. But wind, fogged in. That meant a delay. And it turned into a three-day stay in Shetland while the weather man solemnly shook his head. We were
ronly entertained. The community regarded our presence as its personal responsibility.

By the time the fog at Boston lifted, it was too late to leave. But we boarded aboard the Clipper, and she sailed for New York.

Before we deserted Sheidie's hospitality, we visited a department store and a hardware store in response to a call from a friend in New York. We were all in good time, we said, all in good time.

It is only a short flight from Sheidie to Newfoundland. Though this was July and the ice far in the distance had cleared up by the time we arrived, the weather was perfect. The forecasters, relenting, were trying to rain for us.

The ship sailed majestically toward the east on the great circle route, and we looked down on that strange land, Newfoundland. It is a place that men, caught in the pressure of modern business, dream about. 

The salmon fishing is excellent. The terrain is so odd, admixtures of barren and timbered areas. Lakes abound. Parts of it look as though some enormous hand had raised a mountain chain and then dropped it to the sea. Grace's Lake and the New Harry's Camp airport are a few miles inland from Goosemouth Harbor.

The "night flight" to Ireland is, of course, more of a fact than of a term. Actually, the Clipper breezed through only a few hours of darkness before the rising sun painted their bows with gold. The weather was perfect.

The forecasters, relenting, were trying to rain for us. On the deck above, Captain Gray and his crew were through the endless routine which attends flying the big planes for the greatest economy, weather reporting, checking radio results, and making radio contacts.

In the warm, comfortable quarters of the passenger deck, we gathered round a table on which a cake had been placed. That, plus some refreshers that we had picked up at stores, represented our purchases in Sheidie.

"Now, Mr. Trippe," announced Steve Early, White House Secretary, addressing Juan T. Trippe, President of Pan American Airways, "you will be interested in knowing that this party is in receipt of a telegram from New York.

"It says this is your birthday, and your fellow travelers..." He waved toward the cake and the presents.

President Trippe was completely surprised and greatly elated, blushing like a school girl, standing on one foot and then the other, as glowing compliments were extended to the Pan American System for their great pioneering work.

Steve early and Judge R. Walton Moore, representative of the American Club, had bridged the last of the festivity reigns far into the sunset, and they departed early. One party wanted to stay up for the sunrise but by that time the clouds were all gone and the stars shone so bright that the Irish could see it. Then we boarded the ship, once again, for the final leg of our trip. A driving rain whipped by the wind as the Clipper reached for altitude. In thirty minutes we were on top, in brilliant sunshine.

Deliberately, Captain Gray passed up South-west Point, where a low ceiling was complicated by heavy harbor traffic, and flew on to the navy base at Glastonbury. Then, through broken clouds, we descended under the overcast and cruised back to our terminals.

As the engines were still and the Clipper was made fast, fully a hundred officials of the British Government, Imperial Airways, British Airways and reporters drew along in a specially chartered tug and wrung our hands and gave us welcome as we clambered aboard the tug. The "Yankee Clipper" had been first to inaugurate a commercial service over the "Northeast Route".

The rest of the story has been told in press dispatches—how we were taken to London by special train, given a luncheon by the British Air Ministry and a dinner by Bank of America. The trip requires now only to draw a few comparisons as to transatlantic routes in answer to questions by Colonel Harley Lake of the Securities and Exchange Commission, Imperial Oil Limited, the two companies being our suppliers of fuel for this flight.

Now we are in aviation, airplanes are both a novelty and a commonplace, a novelty because they are instruments of a new era in world communication, a commonplace because, as Judge R. Wiltman Moore, one of the passengers, put it, "Pilots! What did Atwood and Brown do that I can't?"

As yet, "northeast" is a season as compared with the "southern" all-year round. In spite of the fact that the Battoo-Fynes route is about 1,000 miles shorter than that through Horta and Lisboa, and its longest water hop is some 400 miles shorter, we are not so fast.

On the westward journey, that is a telling factor in fuel consumption and payload. Moreover, Bermuda provides an alternation on the southern route. Ultimately, of course, the Battoo-Fynes course may prove very desirable for landplane operation.

What the future holds in the way of routes and equipment depends on the twin sciences of engineering and operating management. The urine and the market of that is for the British. This tumour is only overnight away and aviation has crossed one more mighty frontier to world progress.
Truly, modern life has greatly changed and he most benefited from the research of Rudolph Diesel. As a student until he had constructed the first successful Diesel engine in 1897. Born of German parents in Paris in 1858, Diesel was given privileged education in mechanics by his father, who lectured on the function of pulleys and levers almost from birth. At school, among the French students, he was always first in his class and in place of playmates found enjoyment and education in books and the company of older persons.

In 1870, when the Franco-Prussian war broke out, the Diesel family fled to London with few belongings, but with little money. Because conditions were desperate for the refugee family, Rudolph was sent to a cousin in Augsburg, who educated him at the Augsburg trade school. After the trade school he attended the industrial school and later the Munich Technical Institute where he broke every academic record by the time he graduated at the age of 20.

It was at the Munich Institute that Rudolph was first impressed with the possibilities of a new and more efficient engine. However, it was more than fifteen years before he discovered the answer to his problem. Due to that time, he had been made manufacturing engineer for an automobile company in Paris, became director of the company, and had married.

During his time, diesel engines were not yet practical. However, in 1893, he and his father worked on a new type of engine that was able to run on diesel fuel. This engine was later known as the "Diasel" engine.

The invention of the Diesel engine was a turning point in the history of transportation. It provided a more efficient and reliable power source for ships and trains, and laid the foundation for modern diesel-powered vehicles.

While the invention of the diesel engine was a significant achievement, it was not without its challenges. Diesel faced numerous setbacks and rejections from investors, who were skeptical of the engine's potential.

Despite these obstacles, Diesel persisted and his invention eventually gained widespread acceptance. The diesel engine was a game-changer in the world of transportation, revolutionizing the way we travel and transport goods.

(Continued on page 48)
64 Imperial Oil Employees Have
Eulogized Since the Outbreak of War.

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Calgary Representatives: W. H. Harris
Jno. Blair

Regina Representatives:
Jas. T. Wilson
John E. Gort

Saskatoon Representatives:
Chas. C. Clarke
Colin C. Hunter

Russell P. Johns

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Therapeutic Research:
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Geo. Broeroff
J. E. Murray

Legal Department:
John W. Hamilton

By W. G. CHARLTON, Advertising Department, Imperial Oil Limited.

"Did I ever tell you about Kabonbonoka?"

Our host paused to re-light his pipe, and we sat forward with interest. He was an old farmer at whose place I had stayed many winters and was accustomed to stay for our skiing week ends, and his stories of folk lore had helped while away many an otherwise dull evening. The little pot-bellied stove was throwing out a cozy heat, and combined with the cider we had been sipping the warmth had a decidedly drowsy effect. Outside a blizzard was raging, promising a good day's outing on the morrow.

"You can hear him howling on the war path now," our host continued. "He is the Indian Spirit of the North Wind, and from all accounts is a pretty tough old fellow. Mean, too. The old Indians held him in pretty healthy respect. If I tell you, lagoon, an old chief, told me the story of how the old man was fooled—would you like to hear it?"

He went on to tell us how Shingebis, the diver, tricked Kabonbonoka into his tent and how the roaring fire so weakened the North Wind that Shingebis was able to overcome him and make him promise to stay in his own snowy wastes for eight months of the year, and to visit men only during the four months of winter. Concluding his tale our host knocked out his pipe and said good-night. My friend left with him, but I decided to stay a bit longer—it was much too comfortable by the stove to think of retiring for a while. The stove had burned down, so I added more wood, kicked open the drafts, and went back to my comfortable arm chair. Before I knew it I was asleep.

About three hours later I woke, shivering. The blizzard had stopped, and the moon was shining clear and bright. But I had no eyes for the beauty of the night, for, squatting on the floor near the stove was the oldest and fiercest looking Indian I had ever seen. He wore a great war bonnet and under it his long flowing white hair was hung with icicles.

My first thought was that the Indian had been a bit too strong, and that I was seeing things, so I rubbed my eyes and looked again. The old Indian was still there. Scrubbing up my courage I blurted out, "Who the devil are you, and what are you doing here?"

He answered in perfect English, "I am Kabonbonoka. I wish to thank you for letting me in—it is not very often that the people of these parts are kind enough to let their stoves go out so that I may enter."

I looked at the stove. Sure enough—I had forgotten to close the drafts before I dropped off to sleep, and the fire had burned itself out. I turned to my strange visitor and asked him if he intended to stay the night, as the room was, by this time, decidedly chilly.

"No," he replied, "I won't stay very long. I would appreciate it if you wouldn't light the fire for a while yet, as it is not very often I have a chance to talk to anyone. I get awfully tired of my own company now and then."

(Continued on next page)
Deciding that I could always drive in spite of lighting the fire if he became objectionable, and as I froze, I resolved to draw him out. "We," I said, "how do you find things now as compared to a few years ago?"

"Things are getting tougher for me every year," he replied. "That fright I had with Shingibas was not as bad compared to what I have to put up with nowadays."

"I remember when there were only red men in the land. True enough, Shingibas made me stay away for eight months of the year, and my fellow Indians still held me in great respect. They worked hard all the eight months storing up food and fuel enough to last the winter. And when I went on the war path last year I told you that they stayed very close to their fires." He chuckled, "Yes, I certainly made life uncomfortable for them—imagining having to spend the whole winter in a smoke-filled tent."

I shivered. As my farmer host had said, my wintry friend of the unpronounceable name certainly had a mean streak in him.

"With the coming of the white men," he went on, "I started to lose some of my prestige as being all-powerful. However, I will say this for the old settlers, they also had who a wholesome respect for me when I was on the war path. They took good care to caulk their cabins well, and laid in a good supply of wood to last the winter. But I could usually find a few chimneys in the walls to let them know that I was still boss of the country.

At that, they had to stay pretty close to their fireplaces to keep warm. Those old open fireplaces were very pretty to look at but they sent most of the heat up the chimney, and I managed to keep the rest of the room uncomfortable.

The only startup of my downfall was the introduction of the pot-bellied stove. It was a sad day for me to see a system were introduced in these. Disgraced let it be stated that my coals are snug and warm, but they throw out so much heat that they warm a large part of the room. With one of these old pot-bellies, I know bow I bowling outside their walls. It was in this way, as you can well imagine, that we began to put up false bottoms for our furnaces. Fortunately for me, they aren't anything like the modern furnace systems, and I man god to make the bathrooms fairly comfortable.

People have always had funny ideas on how to get rid of me. About forty years ago somebody developed the idea of running a huge pipe from my homeland, the Arctic Circle, down to our Canadian border. This was the idea that the cold air from the north would cool the land in summer and heat from the combined chimneys of the cities would drive me back to the North Pole in winter. It sounded great in theory.

"About 1800 someone developed the modern hot water furnace system, and my power took another setback. However, I still get some satisfaction out of watching Mrs. Housewife struggling with the ashes and coal shovels of the old furnaces. But there is one thing that is going to be my undoing."

"And what is that?" I asked.

He snarled the word out, "Potroleum. That stuff is the bane of my life. Besides being annoyingly efficient as insulating material in the form of asphalt shingles and insulating paper, it makes possible fuel oil furnaces so that people nowadays have absolutely no trouble in keeping me outside their homes. I can bowl and bluster till I am blue in the face, and they sit snug and warm inside their homes without having to do anything more than set a thermostat. I'm getting to the point where I feel discouraged."

"Even my own kind are using oil in some way to keep me out. Those big Imperial Oil drums make fire wheels, and my fellow Indians weren't slow in finding it out. Even in my own land I run into Petroleum. The Eskimos are using oil drums or oil drip fires in their cabins. There is only one thing that brings me any satisfaction and that is I can still look through cellar windows and find people who are still using the old style furnaces. Every time I hear somebody swearing because the fire is out it does my heart good. Well... I had better be getting along now. I have talked long enough."

Fascinated, I watched as he apparently faded through the far wall. Suddenly he turned back, "Say, young fellow, I'll give you a word of warning. Don't let your stove go out again. I may not be feeling in a good mood the next time I pass this way and you may wake up frozen stiff." With this he vanished.

Outside, the wind suddenly started to howl through the trees, and I hurried to re-kindle the fire.

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**SARNA'S Royal Canadian Engineers**

- **All Officer** of the 11th Field Company, Royal Canadian Engineers, Sarnia, Imperial Oil Employees

**In 1936 when the famous Lemberg Regiment, with headquarters at Sarnia, was disbanded, an infantry company with a long and honorable record of service passed out of existence. The Lemberg Regiment had seen service from the Fenian raids until the Great War and had served in nearly every war of the Empire.**

Organized in place of the Lemberg Regiment were a Battery of Artillery and two Companies of Engineers. The 11th Field Company of Royal Canadian Engineers, established at that time, then became part of a regiment which was organized in 1715, and which has taken part in nearly every battle of importance in which British Troops have been engaged.

The task of organizing the 11th Field Company was entrusted to Mr. Gordon McIntyre, then Manager of Imperial Oil's Technical Service Department at Sarnia. Major McIntyre, an old "Sapper" of the last war, took over the immense task of coverting infantry men into "Sappers" and soon had recruited a Company of which all Sarnia is proud.

In addition to the officers many of the Non-Commissioned Officers were recruited from Imperial Oil ranks.

On September 1st, 1939, when the call for overseas service came, he it is to the everlasting credit of the 11th Field Company that every man volunteered his services.

The 11th Field Company of Royal Canadian Engineers is a construction company, responsible for the safe moving underground of infantry brigades during siege warfare, and in open warfare for the removal of obstacles, building of bridges during an advance, and destruction of communications and creation of obstacles for the enemy in the event of retreat.

The Sarnia Engineers have joined with the 1st Field Park Company, Sarnia, and the 7th Field Company, London, to form the Second Divisional Engineers for overseas service, a combination of seven and eleven which Sarnia's Royal Engineers have already noted.

Photographs of the officers of the 11th Field Company, Royal Canadian Engineers, appear on this page.
PROGRESS OF FLIGHT

(Continued from page 13)

which was constructed in 1816, but never flown. Designed by Sir George Cayley, it utilized the principle now so well known in dirigibles. The gas bag had a covering of Indian rubber muslin cloth, the upper edge being surrounded by a netting from which was suspended the car containing a steam engine for driving two propellers located on either side.

Early efforts to fly were directed mainly at perfecting machines powered by steam, wind, or even gas and it was not until the middle of the eighteenth century that the principle of the glider was put into use. By 1892 gliders, similar to the Lilliephant Glider in (5), were achieving glides of 300 feet.

Orrville and Wilbur Wright had made numerous experiments with gliders and after considerable work made the first controlled flight of a man-carrying, power-driven airplane on December 17, 1903. At that time the Wright airplane, a biplane of the type shown in (6) was prepared for the flight, and when compared with today’s modern machines, for its time was a mere 40 feet and the engine only developed 12 to 15 horsepower.

Aviation activity moved briskly from then on. The year 1909 saw many historic flights, not the least of which was the flight in January of a British Army airplane, of the biplane type of machine fitted with a 30-horsepower engine, of M. Cody succeeded in “flying” the army plane some 20 yards.

The first airplane flight in Canada took place on February 23, 1909, at Baddeck, Cape Breton, with J. A. D. McCurdy, well-known Canadian flier at the controls. The biplane was actively interested in the airplane, and the Curtiss “Juno Bug” (7) were they. Dr. Alexander Graham Bell, the Canadian flier, Lient. Selfridge, of the British Army, was killed in a serious accident. The “Calcutta” (5), built in 1908, was the first British commercial seaplane built entirely of metal. Constructed mainly of duralumin, it carried a crew of three and fifteen passengers, and was used on the Imperial Air Route to India. Ability to take-off and light either on water or land was the main feature of the seaplane. The “Saro Cloud” (6) built in 1905 by Saunders-Roe, three years later and later airplanes were used as many as thirty-three persons were accommodated as did the “Kylla” (8) which had a cruising speed of 105 miles an hour and a maximum speed of 155 miles. The Short “Secon Senior” (18) is an all-metal high-winged monoplane fitted with four engines. The “Albatross” (9) was a further development in aviation history for it not only carried 42 passengers but provided accommodations for 12 persons in sleeping berths at night. It had a normal cruising speed of 204 miles an hour. The Imperial Airways flying boat “Gebid” (8), shown in the position on the trans-Atlantic air mail route between Canada and Great Britain last summer.

The aircraft designer has traveled far in relatively few years, and along with him have marched the technicians of the petroleum industry, who, by continually improving the qualities of gasoline and lubricants so as to adapt them to demands previously undreamed, have made much of this wonderful progress possible.

What does the future hold? Most aviation authorities refuse to prophesy beyond a few years, though the majority agree that stratosphere travel will be the next step commercially practical compound that could transfer the antimonial qualities of tetraethyl lead to a gallon of gasoline. Thousands of miles were run in various types of automibile tests, hundreds of hours of operation were given to at least fifty engines working blocks, running day and night. We thought we knew what we had, but we knew very little about it. We had to find out what would happen, we had to find out what was going on.

For example, we found that we needed ethylene dibromide to mix with the tetraethyl lead. And we were ever to sell enough of the compound to make the discovery a real commercial success, we would need a lot of it. Bromine was then an expensive chemical used primarily for making photographic plates and hard-ware powders. The principal known reservoir of bromine was the sea. But there are only approximately 67 parts of bromine in a million parts of sea water. Could it be extracted commercially? In the course of the work of Mr. Kettering calls the typical “shift-boss” era of a new industry, the Ethyl Corporation spent $500,000 for a boat called the S.S. Ethyl to “mine” the waters of the ocean for bromine. It didn’t work very well; but it proved a point that ultimately resulted in the formation of a joint subsidiary company with Dow Chemical. Today the Ethyl-Dow Chemical Company takes over a million and a half pounds of bromine a month from sea water, at a plant built among the sand dunes of the North Carolina coast. (Imperial Oil Review, June-July, 1937.)

We also had manufacturing problems. The laboratory method for making a few pounds of tetraethyl lead was just a starter. Three plants in succession were built, used awhile, and then abandoned before we learned to make tetraethyl lead in substantially the same way it is manufactured today.

By THOMAS MIDGLEY, JR.,
Ethyl Gasoline Corporation.

The popular notion of chemical and engineering developments is still that of the long-haired inventor in an attic who makes a great discovery and is awarded out of a million-dollar fortune by a stick promoter. The truth more often is like the story of Ethyl, which was over three million dollars in the red before it began to earn a profit.

We are still liable toтерраethyl lead by accident. We did not go into the laboratory on Tuesday and come out on Friday with our product. We did not even know what we were looking for, until a lot of time and money had been spent.

The research started because General Motors began having trouble with knock in motors. Charles F. Kettering fathomed the problem and took responsibility for the two thousand dollars that were needed through months and years of discouraging work. We started in a little room, in a little way; and as the problem appeared more and more difficult, more money was poured into it and T. A. Boyd and Carroll Hockwalt were assigned to work with me. We counted the shelves of chemical supply houses, the volumes of reference libraries, and the possibilities of the periodic table of elements. And when, after years of research which might have seemed fruitless to many people, we came to tetraethyl lead, it was no accident. We knew before we ever manufactured the first test sample of this compound that it was probably what we wanted.

The popular idea might be that when we found tetraethyl lead we shouted hoorayas for it, and all marched in to ask the boss for a raise. Actually, there wasn’t a pause in the program. We started spending more money, doing more research, and looking for other ingredients to go with tetraethyl lead, to make up a...
Research work for a project such as Ethyl is never over. It does not stop with a discovery. The company which developed Ethyl tetraethyl lead ant-knock compounds today has an annual payroll of $700,000 for its 112 people engaged in research work. They are trying to improve on each product and the manner of use: (1) by finding more efficient methods of manufacture; (2) by cooperating with oil companies on research projects to find better ways of using antiknock compounds in motor fuel; (3) by working with automotive companies on cooperative programs to secure greater value from the high-quality gasolines now available; (4) by working with manufacturers of aviation engines on similar problems; (5) by conducting cooperative sales with automotive accessory companies. Perhaps one reason why popular notions of inventions and discoveries—and dif their commercialization—is so far from the truth, is that after the work is done, we are all inclined to narrate our troubles and skip over the mistakes and blind alleys that cost money and get us nowhere. The story of any research project is usually presented in brief and sounds simple. Ethyl has been presented that way before. It is, therefore, probable wise to discuss it in more detail as the tough, uncom- promising problem which it really was. It should be evident to anyone who knows all the facts, that the discovery of Ethyl and the benefits it has brought were possible because courageous corporate executives had the foresight to invest large sums of money and continue the idea through periods when less astute minds might have dropped it. They would not have done this had they not believed in the end they would make a profit from it for their shareholders. They would not have been able to do it had they not previously made large sums of money for their corporations from other ventures, which allowed them to finance this one. They would not have been able to do it had there been any law against their taking the chance of losing the money put into it. For it must be remem- bered that with only slightly different circumstances the whole project of Ethyl might have been written off at one time as a $3,000,000 flop.

We had analyzed our problem, solved it by research, and developed the first methods for manufacture. Now the product had to be marketed. Ethyl gasoline was first introduced to the public in February, 1921. A service station in Ohio attached a contraption to one of its pumps. If a motorist wanted regular gasoline, the attendant pumped it through a hose into a gasoline tank. If he wanted antiknock gasoline, the attendant would turn a pet cock and drops of fluid were injected into the gasoline as it was being pumped through the hose into the automobile. Car owners noticed the difference and told each other about it: "Stops knockers", "more power on hills", "cooler engine," they said. Office service stations installed the contraptions, and finally our salesmen were able to persuade a few oil companies to blend the drops with their gasoline. Manufacturing costs were such that we could not offer the oil companies a profit on the fluid. It cost them 5 cents for 5 cc. of tetraethyl lead and they charged only 5 c. in the motorist for putting it in.

Specifications were drawn regulating the quality of gasoline with which Ethyl fluid could be blended. Procedures were established to test the blending of fluid with gasoline to fully equipped blending plants in oil refineries or as a large terminals of oil companies. A double-check of quality was set up, with laboratories spotted about the country constantly checking gasoline samples to determine their octane ratings, gum or sulphur content, and other characteristics. This inspection, of course, was devised primarily to protect the business health of the Ethyl Corporation. It also has an indirect service to the motorist, although the typical large refiner today maintains standards of quality more exacting than our requirements.

The sale of tetraethyl to a number of large oil companies made possible high compression engine, which correspondingly better fuel efficiency and engine performance. The gradual appearance of these high-compression automobile engines is even- woven with a number of other advances, such as higher engine speeds, better metals, and the sum total of hundreds of minor changes, each adding its increment of improvement. It is therefore hard to measure the independent effect of leaded gasoline on automobile en- gine, but we can say confidently that the existence of leaded gasoline has added annually to North American automobiles approximately fifty times the 1,800,000 potential horsepower of Boulder Dam. The final outcome has been better cars and fuels for the public at lower prices (much lower if you deduct the increased taxes on gasoline); the result has been more cars sold, more gasoline bought, and more jobs created.

Another field in which the continuing efforts of research have led to tangible results is power farming. Five years ago, all tractors were designed with low-compression motors to burn kerosene, distillate, or gasoline. But farmers who burned gasoline in those tractors got only part of the power that was inherent in their fuel. Why not build tractors with high-compression automobile-type engines capable of using gasoline efficiently? That was the obvious question which prizewinners in the market for leaded gasoline. It would also, we knew, give the farmer something he wanted—a tractor more powerful, more fuel-saving, better built in, with about half the bugaboos of oil dilution would be removed. Tractor engineers who had this belief found ready and able assistance in Ethyl engineers and laboratories. A number of field trials were run in the spring of 1921, and the service included as the test product. The test product was successful. Mr. Bower, who had a best of friends. Quiet, unassuming, he had a steadfastness of purpose which made him a valued employee and trusted him to all.

Mr. Bower's passing is deeply regretted by Imperial Oil Limited and the many friends he made during his lifetime.
FOR GOOD AIRMANSHIP

Of the thousands of young Canadians in the past several years who have qualified for private pilot's licenses by training at flying clubs or aviation schools, there are few, if any, who would not admit an ambition to win the John Webster Trophy for good airmanship.

This trophy, a handsome cup which is permanently housed in the Royal Museum at Ottawa, was donated in 1932 by the family of Dr. J. C. Webster of Shadiac, N.B., in memory of his son, the late John Webster who had been killed in an aeroplane accident the previous year. It is awarded each year in competition under the supervision of the Canadian Flying Clubs Association. The competition is open to all amateur flyers and to Junior Air Force officers. The tests are strict and numerous and all aim at developing the highest standards in general ability and aerial navigation.

This year's winner is Dr. Rene Simard of Montreal who was awarded the trophy following competition held at the Toronto Flying Club Airport in September. Dr. Simard is a chemist at the Montreal East Refinery of Imperial Oil Limited. Member of a well-known French-Canadian family, he was educated at Mount St. Louis College in Montreal and in 1929 obtained his Master's Degree in Chemical Engineering at the Massachusetts Institute of Technology. He then went to Germany and was awarded his Doctor's Degree in Natural Sciences at the University of Prague in 1932. He was for two years associated with a Canadian company of consulting chemists and joined the Imperial Oil organization in 1934.

Dr. Simard started flying in 1935 as a member of the Montreal Light Aeroplane Club and received his private pilot's license in 1934. In 1937 he was elected Vice-President of the Montreal Light Aeroplane Club and in 1939 was elected to the Presidency.

RUDOLPH DIESEL'S ENGINE

spark; the diesel compresses only a charge of air and ignition of the oil is accomplished by the heat of compression. As a result, the diesel does not require an electrical firing system nor a carburettor though it uses a fuel injection system to force the oil into the cylinder just before the piston reaches the top of the stroke. The fuel injection system is the heart of the diesel engine; just as the carburettor is the heart of the gasoline engine. Early diesel engines used air compressed to approximately 1,000 pounds per square inch to force the oil fuel into the cylinder but modern diesel engines use a pump for fuel injection. This small pump, one for each cylinder, forces the oil into the cylinder at a tremendous pressure of from 3,000 to 20,000 pounds per square inch. This pressure is equal to water pressure at a depth of from one to nine miles deep. A nozzle on the injector breaks the oil into a fine spray as it enters the cylinder bowl at a rate of 13 miles a minute—780 miles an hour.

The pump and injection nozzle are in one piece and are termed the "unit injector." The unit has few moving parts which are made with a high degree of efficiency. The pump piston, for instance, is fitted to the cylinder pump with an accuracy of one quarter of a thousandth of an inch. Compared to a familiar object, this dimension represents the thickness which would be obtained if a human hair were split into 120 equal parts.

Diesel engines have been operated on a variety of fuels but experience has shown that petroleum fuel oil is by far the most satisfactory. The diesel does not, as a rule, burn crude oil but petroleum oil specially refined for the purpose. It must be fluid enough so it can be pumped and injected into the cylinder; it must be clean so as not to wear the closely fitting parts or clog the fine holes and passages; and it must have proper ignition qualities to burn rapidly. In addition to these requirements petroleum experts have found that one type of fuel, satisfactory at low speed operation, may not work well at high speeds. For this reason Imperial Oil refines three different fuel oils called Imperial Diesel Fuel Oil Special L.S. (Low Speed), M.S. (Medium Speed) and H.S. (High Speed). Imperial Oil also distributes a special oil called R.P.M. Diesel Engine Lubricating Oil.

That the diesel engine will play an even greater role in modern life in the coming years is agreed by engineers the world over. It is only recently that the diesel has been applied extensively to the operation of industry and the wide use made of the new power clearly indicates the place it will play in future years when industry and science will be able to put it to wider use in its present highly efficient state.

AWARDED MODEL AIRCRAFT HONORS

Bob Milligan, of Toronto, and Joel Isenburg, of Montreal, recently won respectively the senior and junior honors in the National Model Aircraft Contest. Part of the award, presented by Imperial Oil Limited, was a plane trip from Toronto to Ottawa and from Ottawa to Gray Rocks Inn by Trans-Canada Air Lines and Laurentian Air Services Ltd. In the above photograph, left to right, are: E. L. Morrissey, of Imperial Oil, Bob Milligan, Joel Isenburg, and Pilot D. W. MacLaren, of Laurentian Air Services Ltd. Both young men seemed to have enjoyed their plane trip very much.

EMPLOYEES DONATE HOSPITAL HUT

In April, 1939, the employees of Imperial Oil Limited and subsidiary companies subscribed to a Trust Fund to be devoted by the Board of Directors to humanitarian purposes. In accepting this fund, the Board of Directors decided that the interest accruing would be divided each year between one eastern and one western division of Imperial Oil Limited. These divisions could then in turn award their share to some deserving charity selected by their Industrial Councils.

This year it was Quebec Division's honor, and they chose to put all the proceeds from their share into the construction of a hospital hut for the Crippled Children's Summer Camp.

In the above photograph the President of the Province of Quebec Society for Crippled Children is accepting the key for the hut from J. H. Montgomerie, left, representing Imperial Oil employees.

WIN VICTOR ROSS TROPHY

Shown at the left are the winners of the Victor Ross Trophy, emblematic of the Softball Championship at the 56 Church Street Club. The trophy, presented by the late Victor Ross, has been competed for annually since 1922. The players are, left to right, hook row, S. Fairfield, D. Taylor, and J. Williamson. Second row, A. Hastings, D. Walker, H. Casey, and H. Williams. Front row, L. Martin, G. Edwards, M. Glennie (Captain), C. Creasy, and D. Baker (Manager). Also a member of the championship team, but not present in the photograph, is G. Ferguson.
NO EXCUSE FOR GUESSWORK WHEN FLYING AN AIR TRANSPORT

There is possibly more scientific equipment packed into the airplane than in any other recent mechanical development, for modern planes are flown almost entirely by instruments. These enable the pilot to set his course, estimate his speed, talk to the airport, and check engine performance while in flight. Listed below are some of the instruments found on the instrument panel of a Lockheed '14,' a standard T.C.A. plane. The location of these instruments is shown in the diagram above.

1. Compass.
2. Attitude Indicator—indicates height of plane above ground.
3. Rate of Climb Indicator.
4. Turn and Bank Indicator—gives angle at which plane leans.
5. Air Speed Indicator.
6. Attitude Pilots—automatically fly plane on a set course called 'Charlie McCarthy.'
7. Radio Pake—two-way radio keeps pilot in constant communication with the airport.
8. Propeller De-Icer Switch—enables pilot to remove ice from propellers.
9. Auxiliary Radio Receiver—this receiver tunes into outgoing radio signals from known radio stations.
12. Cylinder Head Temperature Gauge.
13. Cylinder Head Temperature Gauge.
14. Vacuum Pressure Gauges—indicates whether plane is flying level.
15. Directional Gyro-Compass—measured in relation to magnetic compass (13) but is free from deviation due to oscillation of magnetic compass.
16. Clock.
17. Outside Air Temperature Thermometer.
18. R.F.M. Counter—indicates speed at which engines are operating.
19. manifold pressure gauge—measures pressure exerted in impeller section of supercharged engines.
20. This group of levers includes throttle levers (center), fuel mixture levers (right), gyro pilot control, tailwheel lock, controls for radio, and pitch of propeller.

Survivors of a vanished empire.