THE EDITORS SAY:

THIS ISSUE of The Review carries with it on behalf of the Officers and Directors of Imperial Oil cordial greetings to all its readers and hearty wishes for a peaceful and prosperous New Year.

THE OUTSIDE COVERS are from photographs made at the Canadian National Exhibition and National Motor Show, when the Company, with the help and co-operation of the Museum of Science and Industry in Chicago, presented a comprehensive display relating to discovery, production and transport of petroleum. More pictures and data will be found on pages 22 and 23.

TURNER VALLEY marches on and a new record for drilling was established during 1938 in that area. Some statistics in this connection are graphically presented on pages 2 and 3.

While many people know what a seismograph is, few people outside of the oil industry know how this delicate instrument is used by the present-day oil seeker to locate subterranean structures favorable to the accumulation of oil. Under the title "Knocking at Nature's Door" an effort is made, beginning on page 4, to tell the story in a simple, non-technical manner.

Large expenditures for labour, supplies and materials are represented by the addition of two new tankers built for the Imperial Oil coastal fleet and launched last Fall in Canadian shipyards. With the addition of these vessels the Imperial fleet is brought to a strength of 24. A picture story of how a tanker is built and brought into being is told on pages 10 and 11.

A BILLION DOLLARS is so much money that the editor confesses an inability to visualize it, but one and a fifth billion dollars was the approximate total cost of gasoline tax and motor vehicle licenses to the North American operator during 1937. The average motor vehicle owner in Canada paid $4.77 and the average United States owner $8.93 in gasoline tax and licenses during that year. A revised gasoline tax map of North America appears on pages 16 and 17.

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Fall and Winter, 1938

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EDITORIAL OFFICE—56 CHURCH ST., TORONTO
25 YEARS OF DRILLING IN "THE VALLEY"

A new record for drilling activities in the Turner Valley seems assured for 1938.

As of October 31st last, the total depth of all wells completed since the beginning of the year was 265,056 feet. This compares with 270,220 feet for 1930, the previous record year.

It is estimated that in the remaining months of November and December the depth of wells completed will be approximately 54,000 feet, which would result in a total depth of 319,056 feet for all 1938 completions. The total footage drilled during the year will aggregate approximately 300,000 feet, or just a little less than 57 miles.

A greater average depth per well accounts for the substantial increase over 1937 figures when the total depth of all wells completed was 187,853 feet, or approximately 35½ miles.

The average depth per well in 1937 was 6,957 feet and for 1938, as of October 31st, it was 7,362 feet. During the first eight months of 1938, 36 wells were completed and 3 abandoned. In number of wells drilled 1938 will not set a new record. The 1930 figure of 56 wells is still the largest.

In the accompanying diagrams average drilling depths by years since 1925 and total footage of wells completed each year are graphically shown. Since the summer of 1914 up to October 31st last, approximately 255 miles of hole have been drilled in the Turner Valley.

It all goes to show that a lot of enterprise, a lot of capital and a lot of courage are required to prove up an oil field.

Almost steadily the drill has been hitting farther and farther into the ground in the Turner Valley. It will be noted from the above diagram that in the past twelve years the average drilling depth has more than doubled. An important incentive to deeper drilling was afforded by the discovery of crude oil in 1936.

Since the summer of 1914 up to October 31st last, approximately 255 miles of hole have been drilled by gas and oil seekers in the Turner Valley. The record footage of completed wells was in 1930. Thereafter there was a considerable decline until 1937.
Knocking at Nature's Door


By J. W. DOHERTY, Imperial Oil Limited.

A SK almost anybody what relationship there is between an earthquake and the gasoline that drives a car and he'll probably give up—if he takes you seriously. He may suggest that if you drop a match in a tankful of gasoline there will be a very apparent relationship—but although that would be a smart answer it would not be the right one.

Try the same question on an oil man—preferably one who is engaged in the search for oil—and after a moment of indecision, and perhaps the usual enquiry whether you are pulling his leg, he'll probably say: "Oh, I suppose you mean the scientific method of exploration for crude oil. By this method, miniature artificial earthquakes help prospectors to learn whether underground formations are favorable to the accumulation of oil, if there ever happened to be any oil formed nearby."

And that would be the right answer—an answer which has a good deal to do with the oil industry's ability to keep ahead of the world's steadily increasing appetite for gasoline and other petroleum products.

Earthquakes and oil have not always had this tie between them. The scientific method of exploration is a comparatively new development and to understand its place and value today we must go back and see how oil was sought before artificial earthquakes were thought of.

In the beginning a man who wanted to find oil went about it in the most obvious way. He looked for oil—searched for seepsages in the ground or on the water—and when he found them he made the sensible deduction that there might be more oil nearby and proceeded to drill for it. Of course he could never be sure of finding the oil or of finding it in commercial quantities.

There was also this drawback—that there were relatively few places where oil revealed its presence in this obliging way, and the more promising of these few places were soon prospected.

Of course, at this stage as at all stages of the search for oil there were those who claimed to be able to tell, with the aid of various wild and wonderful gadgets, exactly where oil was located—at any depth—without the aid of surface clues. "Oil smellers," "downers," or "oil witches" they were called. The simplest and most common device used in this form of black magic was a forked switch from a peach-tree which was supposed to switch downwards in the hands of the "downer" when he passed over an area containing oil. Wilders of these divining rods were numerous in the early days of once-famous Western Ontario oil fields but no list of their successes is on record.

In 1883 the search for oil entered a new phase. J. C. White, professor of geology at the University of West Virginia, proved to the satisfaction of the oil industry the antithetical theory of oil accumulation. Sounding scientific and technical, it really was quite simple. Many different kinds of rock are under the earth's surface, each in a layer on top of another, much like a tremendous layer cake. These layers, however, are not always directly horizontal with the earth's surface but are often twisted upwards and downwards, like waves, to form domes or "anticlines" and basins or "synclines." This fact, when combined with the fact that gas is lighter than oil, and oil is lighter than water, brought a perfectly logical deduction.

Oil is usually found in conjunction with salt water and gas in sands or porous rock. Because the gas and oil are lighter than the water, they separate from the water and seek the highest level. When the layer of porous rock is perfectly horizontal there is not much opportunity for the gas and oil to be trapped, but when the strata bend upwards and form a dome or pocket the attraction of this higher level for the gas and oil is irresistible and every drop of gas or oil in the surrounding porous rock tries to reach it. As a result, a pool of oil will collect here and will be prevented from pushing through to the surface of the earth by the layer of hard non-porous rock.

Such a theory, proved conclusively by supporting data, convinced oil prospectors that instead of looking for evidences of oil itself they should seek evidences of antithetical rock formations likely to hold oil. So they tried to judge which way the strata twisted under the earth by clues obtained from surface beds of rock. A
Often, the most obvious methods of learning the earth's secrets was to take cores of the sludgy strata as deep as the drill sank, and by study and comparison, with cores from nearby wells could be constructed a picture of underly- ing formations. This method was used widely and still is, but in the desolate areas of the oil field it was soon abandoned. The stage was set for the development of an entirely new system which would permit the oil prospector to go into virgin country and read its structural character. Something like an X-ray would have done the trick nicely.

One X-ray was not fortuitous, but there were lots of "dowser" and "oil smellers" on hand who were not always as accurate in their readings as "Alice in Wonderland." Many of the oilmen were perfectly honest and sincere in their belief that they have discovered a geyser which really does locate oil. They are untroubled by the fact that the brains of the scientific world have never yet been able to invent such a device— in fact, they usually stress the fact that they have never studied any science themselves and point out that the study of science tends to build up the belief that certain things cannot be done. Another fact stressed is that they have worked on the invention for many years, rarely fewer than ten and often seventeen to twenty, the number depending somewhat on the age of the inventor.

The "dowser" claimed to have discovered that oil exhibits certain characteristics—possibly because in it is somewhat of a mystery. At any rate, working on his theory and by reason of the oil's constant desire to seek out the most remote places, could be located by a suitably connected indicator, failed to find even a burial oil.

Every "doodle-bug" has its own peculiar advantages but one which rated above the average in convenience was capable of doing prospecting from maps without ever going near the ground to be surveyed. Thus, prospecting in China, or Egypt, or Sudan, could be carried on from one's office in New York or Toronto and sea could be served at four. Clear explanation of the "doodle-bug" method of operation has yet been obtained, but its possibilities are obvious.

Perhaps the most thorough "doodle-bug" was that which two unfeathered tricksters used to their own profit in Arkansas. The device was mounted on something like a sedan chair attached to two poles. Carrying it on their shoulders, the pair would walk over the ground to be explored while the mysterious device ticked slowly.

When the examination was completed a turn of the crank would eject a sheet of paper indicating in nicely stamped type the depth, the thickness of the layer, the number of barrels, specific gravity, etc. Needless to say, the "two inventors" never tried to use their findings verified by the drill.

But while "doodle-bugs" came and "doodle-bugs" went, science proceeded to solve the problem in its own way. The seismograph, the seismic balance, and the seismograph were developed as instruments for mapping what the earth looks like underneath. Although they are not as convenient or as infallible as the oil prospector would have liked, they have managed to do almost very well with them during the past few years.

The seismic method of exploration, in particular, has proved of value in some areas and because of its simplicity of operation, has aroused a good deal of public interest.

The seismograph was originally developed to measure the intensity and velocity of earthquake shocks and today there are seismograph stations throughout the world whose job it is to keep a record of the slightest tremors that shake the earth's surface. The oil prospector saw a new use for the seismograph. He reasoned in this way: An earthquake shock sets up vibrations or waves in the earth's surface which are just like the sound waves picked up and amplified by a radio. But sound waves travel through the air at one definite speed, whereas waves passing through the earth have many different velocities, depending upon the kind of rock through which they pass. Why couldn't dynamic
IMPERIAL ADDS

TO THE COASTAL FLEET

BY P. M. DUNCAN, Assistant

Imperial Oil Shipping Company Limited

Two new tankers will be added to the Imperial fleet, bringing the total number of vessels in operation to ten. These vessels, named the "Alvina" and the "Valencia," were constructed at the Cullen-Wood Oilshipways in Québec and are scheduled to be put into service shortly.

The Alvina, a 10,000-ton tanker, will be used for transporting crude oil from the oil fields in Alberta to the refineries on the east coast. The Valencia, a 12,000-ton tanker, will be employed for the transportation of refined petroleum products from the refineries in Ontario to the eastern ports.

The addition of these new vessels to the Imperial fleet will greatly enhance the company's ability to meet the growing demands of the oil industry. With a combined capacity of 22,000 tons, the Alvina and Valencia will provide additional cargo space and improve the efficiency of oil transportation across the country.

The construction of these vessels was a joint effort between Imperial Oil and the Cullen-Wood Oilshipways, demonstrating the strong partnership between the two companies. The Alvina and Valencia are expected to contribute significantly to the growth of the oil industry in Canada.
ment operating on the inland waters of South America.

That there would be no shortage in the tanker tonnage for the handling of this ever-increasing trade, the Imperial Oil has seen fit to augment its fleet by the addition of two new oil carriers for service in the coastwise trade. These vessels, which were designed by the Marine Department of the Imperial Oil Shipping Company, Limited, were launched in the fall. One was built by the Collingwood Shipyards Limited, at Collingwood, Ontario, on Georgian Bay. Incidentally this same firm was responsible for the construction of four other vessels for Imperial Oil, namely, the Royalle, Savioite, Localite, and Talalite, all of which have given long and excellent service on the Great Lakes. The other vessel was built in the yards of the Maritime Industries Limited, Sorel, Quebec, whose well-known skill and workmanship added our first all-welded tanker, Beccescite, to the west coast fleet. This vessel made a most successful maiden voyage last winter, under her own power, from the St. Lawrence River to Vancouver, B.C., via the Panama Canal, a distance of over 7,000 miles. Quite a remarkable trip considering the Beccescite's length is only 120 feet as compared with our 500-foot ocean-going tankers.

After the design of the new vessels was fully developed, detailed plans and specifications were prepared showing the complete arrangement of the vessel and all sizes of material required, together with full particulars of the main and auxiliary machinery. These data were forwarded to the various Canadian shipyards for tenders and the above-mentioned firms were the successful contractors for the work.

These two vessels are of the all-welded type of construction. In other words, the complete steel structure is literally fused together under intense heat by electric arc welding. This system of construction reduces to a minimum the possibility of cargo oil leakage which is sometimes encountered in a riveted hull.

The vessels are built to Lloyd's highest classification and the principal dimensions are as follows:

- Length, overall: 240'-6".
- Breadth: 39'-0".
- Depth: 18'-6".
- Designed load draft: 16'-8".

The main propelling machinery consists of two solid injection diesel engines, supplied by the Canadian Fairbanks Morse Company. They are capable of developing a total of 1,400 horse power through magnetic slip couplings and reduction gears to a single propeller shaft. This power plant will give to the vessel a service speed of 115/2 nautical miles per hour.

Each tank has a carrying capacity of 450,000 imperial gallons and this cargo can be discharged in less than seven hours through the vessel's own motor driven pumps. All auxiliary machinery, including deck ma-

(Continued on Page 32)

Page Ten

HOW AN IMPERIAL OIL TANKER IS BUILT

1. The new tanker is first laid out on paper. Here P. M. Dunsmuir of the Imperial Oil Shipping Company is plotting the hull lines of the recently launched tanker "Imperial".

2. A wooden model is built to scale and tested in a "testing basin". Action of the model in the water is studied for clues that will lead to the most efficient design.

3. The design approved, plates and structural members are constructed. Here, keel and bottom plates are in position and workers have started to erect bulkheads.

4. Pretty soon, through a maze of steel and wood staging, the hull begins to take shape. Erection work starts from the centre and proceeds in all directions at once.

5. In the meantime machinery to drive the new tanker has been built and tested. All Imperial Oil tankers built in recent years are propelled by diesel engines.

6. Once the engine and other large pieces of machinery are set up in the hull, the deck is closed in and the poop deck, bridge and forecastle are then erected.

7. The hull having been tested and declared ready for launching, workmen prepare the "ways" down which the vessel will slide into the water.

8. As whistles blow and crowds cheer, the hull slides down the ways into the water. The vessel then joins in the "lifting basin" to be outfitted with cabins, galley, etc.

9. A few weeks later, the new tanker goes into service. It takes approximately one year to design and build a modern tanker.
By DR. RONALD MACLEOD,
Imperial Oil Limited,
Toronto.

At noon on a Thursday six of us* started off in two cars—a light truck and an old touring car—for a trip to the interior of Peru. The excursion was a major undertaking because in the part of the country we proposed to visit roads are bad, water scarce and proper hotel accommodation lacking. In the truck we had 20 gallons of water, 40 gallons of gasoline, camping equipment, bedding and clothes and shovels, two ropes and chicken wire to help us out of the sand should we get stuck. The cars were equipped with large-size low pressure tires to facilitate travel through sandy stretches. The expedition was really a photographic one as we were equipped with various kinds and shapes of still and movie cameras.

The first night was spent in Piura, 135 kilometers from Talara, which we reached after a four-hour, hot, dirty ride over the punpas. We had arranged for the only bath-equipped room available in the Piura Hotel so that we were really going to rest in luxury for the night. The next morning we set out at eight o'clock for Canchaque, crossing 30 kilometers of heavy sand without difficulty. There followed eight kilometers over fine, powdery clay which filled every part of the cars with dust. The dust was so thick that we had to make frequent stops to see whether we were still on the road. As the old car was not equipped with an air cleaner it breathed in so much dust that it plugged the carburetor and stalled the engine.

Afer driving for some four hours, we reached the first foothills of the Andes and passed through a grove of Cebos trees. The trees are about 50 feet high with huge limbs, and the trunks look like beer bottles painted light green and varnished. The Cebos hang from the tree in pods. It is used as a stuffing for mattresses and cushions, and is similar to cotton. After lunch we started off again, slowly climbing amongst the low-lying, small hills. The road existed in name only as it was a series of twists, turns, bumps, washouts, sand and boulders.

After two hours, we approached the valley of Canchaque with its orange and banana plantations reaching in every direction. Little mountain streams tumble down the hills and the water is carried through small ditches to irrigate the crops. At this point we started to climb in earnest and for the

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* Ernest Wardell, movie dept., Talara; George Kent, Assistant Superintend-
ent, Talara; J.J. Thompson and son, camera dept., Talara; Gordon Howans, retief-
ner, Talara, and the author.

AN ANDEAN PILGRIMAGE

A Party of International Petroleum Employees from Talara go on a Photographing Expedition Across the Mountains.
next hour twisted and turned along a clay road up the side of a small mountain. Eventually we reached Canchaqsi which is at an elevation of 4,000 feet and nestles in a small valley hemmed in on three sides by the first big range of the Andes. The clouds hung low here and the plentiful moisture nourished growth of tropical luxuriance.

After bathing in a mountain stream and regaling ourselves with sweet and juicy oranges which we plucked from overhanging trees, we spent the night at Canchaqsi. We were tired and looked forward to a good rest in the small, clean hotel but we were disturbed by worms singing outside our window. Poor or five of the "young blood," one with a guitar, were serenading a village belle, and they kept it up until 3.50 in the morning?

Again we climbed up the mountain side and after 16 kilometers wound along a newly-constructed road for about 2,000 feet. This eventually dead-ended in a construction camp where the Indians, imported from Chile, were chiselling a shell out of solid rock for another four kilometers, a most difficult piece of road construction.

At this point we then left our car and went by mule almost straight up the side of the mountain until we reached an elevation of about 8,000 feet, where we boarded a two-ton truck that had been carried up the side of the mountain in pieces on muleback. This truck was heavily overloaded with 10 people, plus luggage and freight, but wound back and forth along a tortuous road to an elevation of 10,300 feet. It had become very cold and windy, and as we were not prepared for such severe weather, we all huddled together trying to keep warm. The truck made two or three stops to refill the radiator which was on the point of boiling practically all the time because of the altitude and the necessity of running in low gear almost continually.

From sheer mountain sides we came to a more rolling type of country. There were little farms as far as the eye could see and most of them were badly dried up because of lack of rain during the previous rainy season. We reached Huancabamba where the streets slant in every direction and are paved with flagstones about two feet square, well covered over with ages of burro manure. The town is about 300 years old and certainly it does not seem to have changed greatly for a long while. The buildings are constructed largely of mud and straw—with or without whitewash—and are covered with galvanized iron and tile roofs. Most of them have never been whitewashed and look as if a good puff of wind would flatten them out completely.

The hotel bedrooms which we occupied opened directly onto the street and a small opening over each door was the only means of ventilation. The beds were of iron with wood slats, a mattress about an inch thick and a pillow about three feet long, a foot wide and six inches thick which felt as though it were stuffed with small stones.

As the next day was Sunday the truck did not return to Canchaqsi and so we had to spend the day in Huancabamba. The first thing we did was to buy "ponchos" as we all felt the need of extra warmth, although we were all equipped with two or three sweaters. "Ponchos" are made of homespun wool and are brightly coloured. They look like a blanket with a hole in the middle to slip over one's head. A "poncho" and a pair of pants are the usual clothing of an Indian here and in many cases, his only earthly possessions. At night the "poncho" serves him as a blanket.

Many of these Indians are very small, with jet black hair, pink cheeks, light eyes and fair skin. They are all very polite and say "good morning" and "good afternoon" to everyone as they pass along the street, but we were more or less a curiosity and some ten Indians, when we attempted to take "movies" of them, either froze into statues or scurried out of sight behind a building. Most of them, however, seemed to like to have "still" pictures taken and thought it great fun to pose for us. We spent the day slinging around in the mud taking what pictures we could in a steady drizzle and hoping that the rain would not prevent our return on Monday morning. In the afternoon we saw a cock-fight on which all the local gamblers bet heavily. To our way of thinking it was a disgusting, bloody spectacle.

Greasy roads delayed us until about eleven o'clock the next morning and we got under way in a truck well filled with natives, cases, and raw tobacco. We skidded and slithered along the sides of the mountain, making frequent stops to replenish the radiator. In many places we could look straight down the side of the mountain.

(Continued on Page 27)
GASOLINE TAX MAP OF NORTH AMERICA

- CANADA's three Maritime Provinces lead the North American parade of the gasoline taxing states insofar as the rate of tax goes; New York, Pennsylvania and California are the leading trio in total of gasoline tax revenue raised, figures for 1937 being $61,481,000, $55,711,000 and $46,654,000 respectively. In the amount of tax collected per car, Florida led with $52.67, Louisiana was second with $49.22 and Tennessee third with $44.74.

Revenue from motor fuel taxes for Canada and the United States in 1937 approximated $795,900,000, of which $756,990,000 was collected from the owners of 29,705,220 vehicles registered in the United States and $38,973,947 from the 1,319,375 vehicles registered in Canada. It is therefore apparent that the average gasoline tax per vehicle in Canada was more than the average per vehicle in the United States, the figures being $29.08 for Canada and $23.48 for the United States. It might also be noted in passing that revenue from motor vehicle licenses in the United States in 1937 was $590,613,000, or $13.45 per vehicle, and in Canada $25,993,905, or $19.69 per vehicle. Consequently the total cost of the gasoline tax and motor vehicle licenses in the United States and Canada for 1937 was the enormous sum of $1,220,912,852. The rate at which this total was assessed on the individual vehicle was $38.95 in the United States and $48.77 in Canada. Other taxes such as the 1c per gallon federal tax in the United States and the Canadian 85c sales tax, excise tax, municipal and school taxes, etc., are not included in the above figures. They would swell them very much more, but enough has been told to indicate how largely the motorist contributes to the public revenues on either side of the international boundary.

The map above shows that the lowest rate of the gasoline tax now in effect applies in the state of Missouri and the District of Columbia and is 2c per gallon or (for purposes of comparison of Canada) 2.24c per Imperial gallon. Ten states have a tax of 3.6c per Imperial gallon and among these is California, where the third largest total of gasoline tax revenues was raised during 1937. Eighteen states tax at 4.8c and these include New York and Pennsylvania, which raised the largest and second largest total revenues from gasoline tax in 1937. Of the remaining states, ten tax at 6c, five at 7.5c, one at 8.4c and three at 8.6c. These last three are Louisiana, Tennessee and Florida in which the average total gasoline taxes collected per vehicle were the highest in America.

The Canadian picture is of two provinces taxing at 6c, four at 7c and three at 10c. Ontario, with 623,918 of the 1,319,375 vehicles registered in Canada, and with a tax of 6c, raised $27,644,164 of the $58,973,947 paid in Canadian gasoline taxes in 1937. Quebec was second with $7,078,230; British Columbia third with $3,118,312; Alberta fourth with $2,610,631; Manitoba fifth with $2,270,660; Nova Scotia sixth with $2,006,489; Saskatchewan seventh with $1,937,555; New Brunswick eighth with $1,649,096; Prince Edward Island ninth with $529,232. In the average tax paid per vehicle the ranking of the Canadian provinces is quite different and as in the United States those districts in which the highest rate per gallon prevails, led in the average paid per car. Nova Scotia motor vehicles paid an average of $40.09 each; New Brunswick $39.13. It is interesting to note, however, that ranking third in gasoline tax paid per vehicle was the Province of Quebec at $35.75. Although this province with Ontario enjoys the lowest rate of tax in Canada, 6c per gallon. A large percentage of motor vehicle ownership in the principal urban centres and a lower ratio of vehicles to population with consequently greater mileage per car would seem to account for this. Prince Edward Island is fourth in average per vehicle, the figure being $33.61. The remaining provinces rank as follows: Ontario $28.28; Manitoba $28.08; British Columbia $28.04; Alberta $25.99 and Saskatchewan $18.44. A relatively greater preponderance of small cars, together with financial exigency due to unpropitious crop experiences probably accounts for the low average cost in Saskatchewan.

The figures quoted above are based on returns from the United States Bureau of Revis and the Dominion Bureau of Statistics.
If there were neither mountains nor tangle jungles, if there were no desolate or rough terrain, however easier it would be for man to move about! Admittedly, the world would hardly have been as interesting as it is in its present unreasonable make-up, and it is idle to ask why the good Lord, in creating the Earth, didn't give due consideration to the coming of Henry Ford and the motor car. Still, here we are, with a world thrown together in a way that makes it a virtual nightmare for the road builder.

For a glimpse of primitive communication, it is not necessary to delve into antiquity. Right now, in Africa, Asia or South America, there are survivals of primitive man in all stages of his growth as a gregarious animal. The jungle metropolis is at best a crude stockade and a huddle of huts. The need of such a community for travel and communication is limited. The river and the jungle footpaths are sufficient for these primitive beings, so why put forth extra effort for something so unnecessary as roads? The savage has nowhere to go, and he hates his neighbours in approved jungle fashion!

Flying over any part of such vast wilderness as the Amazon watershed, especially when following stream or river courses, one sees the occasional lonely clearing, a huddle of tribal huts on the river bank, and the native's means of transportation, the dug-out canoe, ready to hand. The range of primitive man's travel on land, whether by cleared path or animal trail, is on the whole quite limited, in fact, the antelope and the cougar range over greater terrains than the savage ventures from his tribal village.

But no sooner do we find man aspiring to a semblance of civilization than we find him building roads and even constructing pavements on these roads, much the same as we know these today. This is particularly noticeable from records and remains of ancient Assyria and Babylonia, and while these civilizations can really be regarded as mere enlargements or further developments of the tribal aggregate, yet their road building and especially their pavements have some remarkable similarities to our present-day work. It is strange to note the oneness of the ancient civilization, the advances made by those men in some particular art or craft and the crudity or primitiveness of other and important human pursuits. Road-making and paving, for instance, were developed to a degree that would rank quite high even today. On the other hand, these activities were entirely concentrated in a few large cities, separated by vast, and in most cases uninhabited distances. The work that we would designate today as "city street paving"

with little or no highway construction outside the city walls. There was no public demand for roads in the modern sense. The social set-up was a mass of slaves, a few freed men, all owned and controlled by a remarkable small upper crust; scarcely a sound situation.

Ancient Egypt, Assyria and Babylonia were all semi-arid countries; sandy wastes not much obstructed by mountain ranges or jungles. Transport was mainly by the backs of slaves; human beasts of burden who trudged under loads over the burning sands. Great as the Assyrian and Egyptian kingdoms loom in ancient history, and impressive as their remains may be, vehicular traffic was negligible.

Yet, while communication between cities of that day was in most instances a simply defined route that would hardly be recognized as a road in the modern sense, in large cities such as Babylon, road building and paving ranked in importance with construction of palace and temple. In fact, paving in Babylon was in many instances an extension of the palace or temple base. The most acceptable material for paving and building in that day would have been stone blocks, but stone was not obtainable on the sandy plains of Assyria, so they developed clay and sand clay bricks. In its limited fashion, human ingenuity of that time wasn't much behind what it is today. They, too, tried to make the best use of the materials at hand; only on rare occasions did they go considerable distances to obtain stone or other special materials. There was sand and clay, so they made these into bricks, and they soon discovered the nearby natural asphalt deposits and how this black, sticky material would cement the bricks together. Some of the Babylonian remains are really amazing. One can hardly distinguish between their asphalt-jointed bricks, sand-asphalt mastics, and modern work of the same type.

1 - Apache Way, Italy. Rome to Bariadne. Begun in 312 B.C., by Agatius Claudius, Roman general. 2 - Avenida Rio Xavante, Brazil. One of the world's most magnificent streets. Built of concrete at a cost of $80,000,000. 1914. 3 - Grand Trunk Road, India. Calcutta to Afghanistan. In use 1890. 4 - Summer Palace Road, China. Stone slab highway built by Emperor Kang Hsia in 1709. 5 - Road to Baghdad, Iraq. Paved by the Romans between 300 B.C. and 250 A.D. 6 - Modern Motor Highway. Typical of thousands of miles of asphalt pavement throughout Canada and United States. 

*Editor's note: The illustrations, with the exception of Nos. 6 and 13, are from the Ford Motor Company's "Roads of the World" exhibit at the Chicago World's Fair and the "Roads of the Pacific" exhibit at the San Diego Fair, and are published through the courtesy of the Ford Motor Company.
If space and time would permit, we could show that these ancient men handled asphalt materials for paving and other construction much as we do today, and point to evidence of development along systematic, scientific lines. Possibly asphalt technology did have its beginning in the year 3000 B.C.!

The ancient civilizations in the East appear to have been distinctly city civilizations. History often refers to them as "Empires," but in reality the sway and influence of, we will say, Babylonia, extended only a few miles beyond the city walls. Some ambitious or adventurously-minded king may have sallied forth out of his empire city in quest of new lands. At times we find this or the other king attacking cities or countries as he goes along, but these territorial acquisitions were temporary. The conquered territory could not be knit into a state, into a connected organism, as there were no roads, or network of communication. Hence, the popular method of the day: completely destroy the conquered city, load the spoils onto the backs of the able-bodied captives and massacre the rest!

With the development of the Roman Empire there is an appearance of the idea that permanent sway over a conquered land could not be had except by some form of rapid, constant and regular communication. Hence the building of highways. With this development came a change in the concept of conquest, in the consolidation of Empire and in the manner of exploiting the conquered country. It was only by means of roads that the Roman Empire could control the new lands invaded. Inordinate massacre of population and destruction of cities decreased as communications improved— at least during the time of the Roman Empire. The logic of this

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is evident. If there is communication, if garrisons can be stationed at strategic points and rapidly moved about, it is foolish to lay territories waste instead of organizing them to provide income for the conqueror.

Thus, we see how the Romans rapidly grew out of the period of Panhican wars and by extensive road building they not only began more effectively to use their conquests for the benefit of Rome, but actually to absorb the conquered. The unreasonableness of destroying a city and driving hordes of slaves back to Rome became clear. Over 70 per cent of the Roman population were slaves to start with, why bring in more mouths to feed, with no work to do? Even in that day they had their labor problems, the unemployed and the slave, all of which finally did them under.

Time hardly matches on, or onward, except on the radio and in the movies. Actually, in the panorma of human affairs, time stumbles along, often entirely loses its way, and is found gaping amidst the historical tangle, completely bewildered as to where to march or whether to march at all.

Rome built roads and over these roads the Romans marched to hold their expanding empire and to conquer ever further. That is where Imperial Rome failed. They built roads mainly for conquest, and on these roads they rushed on and on away from Rome, and only too often entirely forgot the City on the Seven Hills. The Rome they left behind decayed, crumbled and was finally demolished by the mud, hungry mobs within and the barbarians from without. The Roman highroad became a relic for the tourist to stare at.

And then there is a long pause. We are in the Dark Ages. No one reads or writes except a few isolated scholars in deep monastic recesses. Strongholds are built on craggly heights and the peasants submit in voluntary servitude to the owner of the stronghold in order to have protection from the bandits at large. Roads become a nuisance. They made invasion easier for the neighbouring robber barons.

Not until the baronial districts became principalities, and these in turn were merged into kingdoms, do we see the renaissance of road construction. First comes France, then England, and there is a distinct evidence of the highroad for commerce or transport of goods. Road construction begins to have a modern background. It is not entirely military as in Imperial Rome. There is, however, another very noteworthy difference. In France and in England there appears the factor of costs. When Rome was overrun with slaves many of these were driven out along the highway routes, into the nearby stone quarries. Mountains were leveled where a slight deviation from the straight line would have saved thousands of man-days of work (we can't yet speak in terms of money). The road-bed was 4 and 5 feet in thickness, constructed of broken stone, and the surface was laid with carefully jointed granite slabs, 1 foot thick. But in the 17th and 18th centuries, in France and England, while labor was cheap, there actually was not always an over-supply of it. If these countries had driven in large masses of slaves from the outside, they would have been hard put to feed them, so road building changed materially. Unconsciously, there appeared what we know today as road construction economics, a sense of proportion in expenditure of human effort.

It was the beginning of the Past Road. Men started to communicate by writing. There developed a credit and banning system and we have the era when a person could step into a coach and travel 30 or even 100 miles away from his city or town in comparatively safety. Even during the height of the Roman era, such journeys could not be made except with numerous armed retainers or guards. Safety from robbery and even murder on the highroads constituted so vast a change that the advent of the Past Road enabled men to live together, though many miles apart.

Again, a word on costs and how they built roads in that day. Without slaves, France and England were forced to approach the problem of road building in a more rational manner. In France these developed, even as early as in the 17th century, primary and secondary road systems. True enough, the extent of these road systems was negligible compared to today. Even as late as the Revolutionary period, the primary road system of France did not exceed fifteen hundred miles. Roads were not measured in hundreds kilometers. It is impossible to determine what the secondary road system was, but it probably wasn't any more than a couple of thousand kilometers of the kind of road negotiable by horse and cart.

(Continued on Page 30)
GREAT interest centred in the Imperial Oil exhibits at the Canadian National Exhibition and the National Motor Show this year. For the first time a comprehensive display relating to prospecting for oil, drilling and transportation, was available to Canadians and the crowds continuously thronging the exhibit, and their comments, indicated that recent developments in the West have made Canadians quite oil conscious.

A diorama of the Turner Valley oil field with the moulded contours merging into a winter background and with miniature derricks dotting the landscape was an unfailing attraction. Below the surface the geological formation of the field was exposed and automatically a recorded lecture on the field was delivered while lights focused attention on the points referred to.

Models of oil bearing structures, geological specimens and illuminated slides telling the story of how oil was formed and accumulated were of unfailing interest; and working scale models of drilling rigs always attracted attention.

The exhibit was effectively set off with modern lighting and the walls were inset with numerous large illuminated transparencies illustrating production, drilling and transport activities. Miniature stages designed and built by Canadian craftsmen and illustrating scenes in South America, the old Western Ontario fields, the Turner Valley and the Canadian Arctic, also attracted much attention.

Six men were continuously employed for four weeks in setting up the exhibit and the electric current consumed each day to illuminate it and to drive the 17 motors used to operate the working models was approximately the amount that would be required to illuminate 200 medium-sized houses.

The Museum of Science and Industry in Chicago co-operated with Imperial Oil by lending many of the specimens and working models displayed. Without this assistance the exhibit could not have attained its impressive proportions except at prohibitive cost.

FALL AND WINTER, 1938
THE LATE ORMAND BEACH

Villain of amateur sports, and employee of Imperial Oil Limited throughout Canada were shocked to learn of the accidental death, on September 21st, of Ormond Beach, a loyal and efficient employee in the Sarnia refinery, who had won national fame as a football player of unusual ability and perfectly sportsmanlike qualities. The following article by Vere deGee, Sports Editor of the Windsor “Daily Star”, is reprinted by permission of the “Star”. There is nothing the editors of “The Imperial Oil Review” could say which would add to this picture of a remarkable athlete and a fine gentleman.

There’s nothing that gets at your eyes and your throat when you come to realize that Ormond Beach is no longer part and parcel of the Sarnia Impalrs in Eastern Canada senior rugby football.

Of the countless number of former American college gridiron stars that shifted to the Eastern Canada grid ranks in recent years, Beach stood out as the head-liner in department on and off the field, and in power-house execution of his duties on the field.

Ormond’s sudden passing early Wednesday morning as a result of an accident in Sarnia, stripped from the Imperial’s football club a dominating figure and left gridiron foe, as well as scrimmage pal, gasping for breath.

The influence exerted by Beach in Eastern Canada football in general and in Sarnia in particular, is beyond measurement by any yard-stick of wood tributes. Born at Ponca City, Oklahoma, and educated on the campus and in the classrooms of Kansas University, Beach was moulded of remarkable athletic clay, Nature possessed him with a powerful frame, keen vision, agile limbs, a fighting heart, and above all, the spirit of a champion.

Beach’s introduction to Eastern Canada football came as a rude jolt to an athlete who had been steeped in the lore of hard-tackling, hard-running and clean tackling.

The first time Beach logged a ball in Canadian football he was stopped by a rock on the nose. It was new defensive treatment for the bally former Kansas University grid star, who had done considerable bumping against some of the greatest linemen in the mid-western states. He took the bump on the nose and said nothing. Beach was sent on another line-plunging excursion. He was stopped by the same nose-poking method. When Beach came out of that play he was probably as close to losing his temper as he ever came in his five years of campaigning with Sarnia Impalrs.

Conquering an urge to swing at his aggressor, Beach appealed to one of the whistle-toters, who was close enough to both nose-wallowing plays to feel the rush of air that accompanied them. “Mister Official,” Beach asked with all the polite-ness he could muster under the circumstances, “is that the way they stop a play in this game?”

The official scanned Beach’s 240-pound frame, scooted rudely and answered: “Listen big boy, you’re big enough to take care of yourself, aren’t you?”

Beach never forgot that incident in his Eastern Canada senior football baptism. Yet a controlling urge kept him from ever adapting with the powerful weapons of retaliation at his command, against slugging opponents. And it was because Ormond elected to continue to try to play clean, hard, football that he left behind him a noble heritage for the budding gridiron players of Sarnia, and the rest of the Dominion.

We recall Beach’s clean-cutting with Sarnia Impalrs as if it were yesterday. Far and wide, word had been spread of Ormond’s prowess as a forward passer. The idea seemed to prevail in some sections of Eastern Canada that any U.S. college grid player must be gifted with forward-passing skill. Game after game went by with Beach ranging the Sarnia backfield as a battering-ram plunger and a bloodhound on the defense. He gave to Eastern Canada football a type of secondary pivot power never seen before. Yet he did not toss a single pass.

As time went on, it was revealed by Beach himself that he had never thrown a single forward pass in all his Kansas University career. He alternated between a defensive fullback, and a halfback position. His forte was lineplunging. He was regarded as one of the

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FROM TROPICS TO TWINE

Canada’s Bread Supply Literally “Hangs by a Thread” — A Thread of Binder Twine Made From Tropical Fibres and Colombian Oil.

By W. G. CHARLTON,
Imperial Oil Limited.

MANILA from the Philippines — sisal from British East Africa, Yemen, and Java, and oil that had its origin in far off Colombia combine to make the binder twine mill of the International Harvester Company of Canada Limited at Hamilton a melting pot of international raw materials.

Binder twine, used in harvesting the greatest part of the world’s wheat crop, is the product of a careful blending of oil treated manila and sisal fibre. Because manila and sisal cannot be grown in North America, a ball of twine travels thousands of miles and passes through many different hands before the Canadian grain grower places it in his machine.

Looking like miniature jungles, the manila plantations of the Philippines supply the bulk of the world’s manila fibre. Peculiar to the southern Philippine Islands, Samatia and Borneo, is the soil composed principally of volcanic ash which is the natural home of the fibre-producing Abaca plant. Efforts to grow this plant elsewhere have failed, and so these far-off islands continue to supply this manilla fibre that is required for the manufacture of binder twine.

If you can imagine a stalk of celery from 12 to 20 feet high you will have an idea of the appearance of the Abaca plant. The trunk of the plant is made up of thick overlapping layers like celery, and it is from these layers that the natives, using simple, home-made tools, draw the fibres. The plant takes from 18 to 24 months to mature and is self-sustaining with new shoots continuously replacing those that are cut down.

British East Africa grows the henequen plant from which sisal fibres are drawn. In cooperation with the manilla plantations, which are usually in plots of five or six acres, each tended by a single family, the henequen plantations represent the last word in modern nursery methods. The henequen plants resemble the cactus plant and are first set close together and when two years old are transplanted to rows about eight feet apart. From 1,200 to 1,400 plants may be grown in an acre, and the plant takes from four to seven years to mature. Sisal grows in different parts of the world, but the fibre produced in British East Africa is more adaptable than any other to Canadian specifications.

From these distant places the dried and baled manilla and sisal fibres are brought to warehouses located at strategic points accessible to shipping. From there the fibre takes leave of the natives of the tropics who produce it and is shipped to Hamilton where

The first hand to touch the fibres from which binder twine is made are those of dark-skinned natives of the tropics. Sisal fibre comes from the leaves of the henequen plant (left) grown in British East Africa, Yemen, and Java. Manilla comes from the Philippines. When cut, the manilla plant (above) looks like a stalk of giant celery, 12 to 20 feet in length.
Ingredients with it. The amount of oil varies with the species of fibre making up the twine, some requiring more oil than others.

The oil used by the twine mill of the International Harvester Company is refined at Imperial Oil's Sarnia refinery, and arrives at the mill in tanker trucks which leave home down Lake Erie, through the Welland Canal and across Lake Ontario to Hamilton. The oil is pumped from the tankers into a 500,000-gallon storage tank in the mill yard, and from this is pumped, as needed, into smaller mixing tanks inside the plant, where it is heated and mixed with other ingredients. It is then circulated to the first breakers.

One of the principal ingredients of the oil mixture is a insect repellent. Our friends the grasshoppers and crickets make this necessary, as they eat anything with a saline base and unstemmed bender twine would be inviting from these pests. The International Harvester Company uses two kinds of repellents, one practically odourless and the other with a very distinct tar or creosote odour. Both these repellents are the result of testing and experimenting with many kinds of materials which have been recommended for this purpose. This experimental work never ceases. At the present time the effects of various kinds of repellents on large numbers of grasshoppers are being carefully noted, and, if a more efficient one is found it will immediately be put into actual production and its effect noted in the field.

The economical and efficient harvesting of wheat literally hangs by a thread of bender twine. Despite the increasing popularity of the harvester-thresher in the exclusive wheat growing countries the greater part of the world's wheat supply continues to be cut and bound by the grain binder, which in the simplest form would be merely a mowing machine. Thus, man's ingenuity, using Mother Earth's gifts from the Philippines, British East Africa and South America, is instrumental in aiding the Canadian farmer to harvest his wheat crop quickly and efficiently.

Tropical fibres become balls of bender twine. A series of complicated machines (left) straighten and blend the seed and manila fibres into the correct proportions, the resulting loosely arranged fibres being known as a "sliver". On the spinning machines (below) the sliver is divided into a single strand of bender twine which is wound into balls which are wrapped into sacks containing six balls. (Below) Twine stored in this warehouse at Hamilton awaiting the harvest.

An Andean Pilgrimage

(Continued from Page 15)

for 1,000 feet or more and we also had to pass several small washouts in the road where there contained only about six inches between the wheels of the truck and hundreds of feet of thin air. The driver was an Indian who did not seem very happy in any weather and could hardly have worn a medal for his daring!

As we went over the highest point, we saw an Indian sitting on a rock with his poncho pulled around him, staring out into space and not seeming to mind the cold which was slowly freezing us. Not long after going over the pass we reached the Pacific side of the mountain range and the air became milder.

About two hours after we reached the point where our roads reunited and we began the return journey down the mountain side to Cordoba.

Riding a mountain mule is very disconcerting because these animals always go to the very outer edge of the path, and as this engages all the way, at many turns they head and rocks project out over space before they navigate the turn which you think they have forgotten to make. As you sit and look down ten hundreds of feet you wonder how many times you will bounce before you hit the bottom! On the trip up we had to urge the mules forward all the time but on the downward trip we had to hold them back because, left to themselves, they would almost run down the precipitous path. Just before we reached the car in the first of the small town of our party sped a huge tamarind as big as a man's head. We got out our movie camera and took pictures of it as we felt people at home would find it hard to believe that such big things existed. Fortunately we again reached the hotel in Cordoba and after having another bath in a mountain stream, retired early in readiness for an early start the next morning.

At six o'clock on the Tuesday morning we were off again for Talara and reached Piura, after a rough trip, at one o'clock in the afternoon. Just outside Piura the old car was running so hot we had to stop. During the trip it had breathed through the front of the cylinder heads had become worn and it was now nearly impossible to keep oil in the engine. However, by making frequent stops to add oil, we were able to reach Talara at six o'clock, after having covered 275 kilometers of the very toughest kind of going. The trip was certainly well taken pictorially as we had exposed about 200 "still" pictures and 12 rolls of black and white and coloured film during the vacation.

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Fall and Winter, 1930
WHAT IS THIS THING CALLED "ROYALTIES"?

If you or I were to buy a desirable home-site in the City of Toronto or its environs, our devil would probably entitle us to possession of the surface, the sub-soil, the stratiﬁed ashes, garbage, decaying automobiles and such assortment of sometimes accumulates on vacant land, and whatever bed-rock nature had provided for a foundation. If we cared to explore vertically we might eventually tap our share of the earth's molten centre, or meet our nearest neighbour from China similarly employed, but everything lying beneath our '50's 120' would be ours to have and to hold, with of course the usual formality of paying taxes and assessments for local improvements.

Were we to face forth to Western Canada and buy a quarter section within hailing distance of Calgary or Edmonton, we might ﬁnd that our liberties were somewhat restricted. In the pioneer days we might have stumbled on a bargain, but once it was established that there was coal under 'them thar hills,' a provident Government, when disposing of its lands, reserved to His or Her Majesty, His or Her heirs and successors, all the coal and similar substances underlying the purchase. As the country was explored and its resources further determined, there was added to the coal and precious metals, petroleum, natural gas and other hydro-carbons, and, as an up-to-date touch, helium.

The Railways and Hudson's Bay Company followed a similar procedure with the vast tracts alienated to them for services rendered, so it all depends on the date or conditions of purchase whether you merely own the good earth, or whether your interest goes deeper in your little grey home-site in the West.

Naturally such a condition complicates the task of the secker after oil. He may lease petroleum rights from the Crown and still have to dicker with the land-owner for a right of-way and the surface rights for a well site. In rare instances he may find the petroleum rights in the hands of one party and the natural gas the preserve of another and how to drill a well without infringing on these opposing rights is quite a problem. He may discover that petroleum and gas rights have been ﬁlched in an as major pastime and have passed through several hands, each retaining a little something for his trouble and future enrichment. He is lucky if he can deal directly with the Crown or the Railway Company or a holder in Fee Simple, because then there are only "The Party of the First Part" and "The Party of the Second Part" involved in the deal.

Needless to say the retention of the coals, the golds, the precious minerals, the oils and the gases by the original land-owners was not a mere accident, but was designed with a view to providing a source of revenue at a later date. The Crown will not bother to mine the coal; the Hudson's Bay Company may not go in for gold-mining; the C.P.R. may not drill wells for oil and gas, but anyone who engages in those pursuits will, of necessity, undertake to give a percentage of the material recovered, not, mark you, of the predate of their enterprise but of the materials recovered, to the fortunate possessor of the subsurface wealth. This is termed a "royalty," and on these royalties let us pause.

A simple illustration of royalty in operation would be if Tom Jones leased the oil and gas rights from the Crown on a Legal Subdivision of 40 acres, and, at his own expense, proceeded to drill a well therein which proved productive. If his acreage was in wildcat territory he would pay to the Government a royalty commencing at 5 per cent. and increasing to 10 per cent., but if he was operating in a recognized productive field the royalty would commence at 10 per cent. with the assurance that, in 1930, the rate would increase to 12 1/2 per cent. When an oil company bought Tom's crude, they would pay him for 90 barrels out of every 100 and remit the difference to the Government, but, if the Crown so elected, it could erect storage tanks on Tom's lease and he would be obligated to divert 10 out of every 100 barrels into these tanks, leaving him 90 per cent. of the output of the well to repay drilling costs, operate the well and winter at the Coast. If it turned out to be a good well, well and good, if not — .

On a somewhat different basis would be the case of Jack Black, who, noting the derricks rising in his neighbourhood, leases the oil rights on 40 acres from the Railway Company, who may be content to reserve to themselves 10 per cent. of the petroleum, casinghead gasoline or natural gas developed from the lease. Jack is a speculator, not an operator, and he contents himself with paying rentals for a few years whilst development proceeds. In due course a promoter contacts Jack and takes a sub-lease on the property. Jack retaining for his own beneﬁt a 5 per cent. interest, additional to the rentals and royalties already reserved. The promoter induces an oil company to drill a well on a 50-50 basis, that is paying half of the drilling costs for a half share of the well's net production, and possibly retains a 5 per cent. royalty for himself for his trouble. As the well will cost perhaps $160,000 to drill, he forms a company and issues stock to raise half of that amount, say 800,000 shares at 10c a share.

Suppose that under these arrangements the well makes 200 barrels a day for its first year of operation, or a total of 75,000 barrels. Of that, 7,300 barrels (being 10 per cent.) will go to the Government; 3,000 will go to Jack Black; a like amount will go to the promoter; and 58,400 barrels to the drilling company to pay operating expenses. The remainder will be divided ﬁfty-fifty with the promoter. After paying operating expenses of say $5,100 per year this oil may, at $1 per barrel, provide $53,000, one-half of which, or $26,500, would be a credit to the 800,000-share company, representing roughly 3½c a share, or approximately one-third (Continued on Page 35)
ROADS THROUGH THE AGES (Continued from Page 21)

Although there were no properly defined construction methods, road work was carried on along tolerably sound lines. In Northern France, for instance, great emphasis was laid on proper draining as a means of keeping the roadbed dry, and on heavy ballasting of the base.

And now we are within sight of the industrial revolution. The appearance of Newton gave man a mechanistic conception of the world about him. The principle of division of labour intruded. The advantage of integrating human effort became apparent. Thus, instead of one and the same man making the whole wheel, from felling the tree in the forest to shrinking on the rim, the different operations such as cutting the wood, carving the spokes, etc., were undertaken by different workers. All this tended towards an immense increase in production and with this, distribution and transportation became problems of real importance.

But even at the threshold of the 19th century, the primary purpose of the road is still military. A road was something that could be negotiated by means of war, beasts of burden, artillery and carts. Only with the passing of the Napoleonic era and with thought in England and on the Continent tending more to production and to integration of labour, does the principal purpose of road construction become commercial.

In England we see the development of a type of road known as Macadam, the modern "water-bounding macadam," named after its inventor, J.L. McAdam.

Broken stone was used in road construction in uncountable ages past, but McAdam made a notable, though simple, discovery: that if he breaks the stone, separates the different sizes and first starts with the largest fragments and compactes these into a layer, he can then more easily and systematically fit the smaller sizes into the interstices or space between the larger fragments. This method of handling the crushed stone produces a far more solid layer than indiscriminate application and consolidation. McAdam also observed that when it came to fitting the smaller particles into the interstices between the larger fragment, he carefully shaped them when it came down to particles as fine as dust, water helped to float and place the smaller particles in the voids, and resulted in a greater chance and reliability of the whole compacted line.

This process now seems elementary, even to the layman, but actually it was a notable discovery.

Soon after, native asphalt rock was discovered on the eastern Canadian Coast. The development of its use through various stages makes an interesting chapter in the history of road construction and paving. The modern city pavement, for instance, began with the observation that when fragments of the natural rock asphalt dropped from the carts that transported this material, these fragments consolidated under the wheels and formed a waterproof and rubbery surface. From this observation it was only a step to taking the native rock asphalt, breaking or pulverizing it, spreading the pulverized material over prepared road beds and then consolidating it by pounding or rolling.

Thus, as we came to a time in the 1860's where Paris streets are surfaced with smooth asphaltic surfaces laid over the intolerable cobblestones. People of that day greeted this new ammoration as a marvellous discovery. To them, it was like rubber pavements. Fancied the silence that descended on a street surfaced with this material in comparison with the rattle and rattle of cart wheels over the uneven cobblestones.

From there on, the development of city paving was rapid and soon became an industry of no mean proportions, ranking as one of the outstanding activity in civic improvement. But it was still a far cry to the highways of today. In fact, the importance of highways materially declined with the advent of the railway. What chance had the horse and cart against the locomotive pulling numerous large cars at a speed unheard of until that day? For a time it seems as if road construction and paving would be entirely restricted to the cities and that the land at large would be spanned in all directions by iron horses, and then appear the internal-combustion engine and the motor car, creating a new, insistent demand for more roads and better roads. This was the genesis of modern road building in which are mingled the crafts developed through the ages and the highly specialized skill and knowledge of the present-day highway engineer.

THE LATE ORMAND BEACH
(Continued from Page 24)

After the completion of the 53,000,000 cubic yard project, the next phase of the Ormand Beach was undertaken. This project was the construction of a major highway along the eastern edge of the project area. The highway was to be 100 feet wide and 20 feet deep.

The contractor for this phase of the project was the Associated Road Builders of Canada. They were responsible for the construction of the highway as well as the installation of the drainage system and the installation of the tunnel system.

The tunnel system consisted of several large tunnels which ran under the beach and across the bay. These tunnels were necessary to provide access to the beach and to the various sections of the project area.

The construction of the tunnel system was done using a combination of techniques. The tunnels were excavated using a combination of hand and machine excavation. The machine excavation was done using a variety of equipment including drills, excavators, and cranes.

The construction of the highway was done using a combination of techniques as well. The highway was built using a combination of concrete and asphalt. The concrete was used for the base and the asphalt was used for the top layer.

The construction of the highway took several years to complete. The entire project was completed in the late 1930s.

The completion of the highway marked a significant step forward in the development of the area. It provided much-needed access to the beach and to the various sections of the project area. It also helped to stimulate economic development in the area.

ROYALTIES
(Continued from Page 29)

go of the gross earnings of the well. It is simple arithmetic to calculate what the return would be if the well came in at 100 barrels, or at 1,000 barrels, and the corresponding reaction on the balance sheet. It should be borne in mind that the figures here given are purely arbitrary and are used merely to illustrate a method of calculation.

The poet has said "things are not what they seem" and, as you watch the oil pouring from the well into storage, it might be well to remember that all of it will not eventually find its way into the pockets of the share holders in the form of coin of the realm. There’s a leak in the tank through which, in greater or lesser amount, is drawn off the royalty oil for the benefit of the sleeping partners, these Parties of the First Part, the Second Part or any succeeding part, who, for what is sufficiently referred to as “valuable considerations” have retained a finger in the pie. And out of what remains there are operating expenses, taxes, etc., to be paid before the shareholder can expect dividends to brighten his bright grey home-site.
TWO NEW TANKERS

(Continued from Page 10)

chimney, will also operate under electric power supplied
by independent diesel generators installed in the engine
room.

In order to insure proper fire protection a complete
LeX chemical fire extinguishing system is installed. Fire-
smothering gas can be released in a few seconds from
steel cylinders through a system of piping and nozzles
for any part of the ship by the use of remote controls
located at different stations throughout the vessel.

Ample accommodation is provided on the upper
deck for a crew of 24 men and each of the five wash-
rooms is equipped with hot and cold water showers.
Two large mess rooms are located on the after deck and
a refrigerating plant insures fresh supplies for the
galley.

The transportation of a liquid cargo by sea is very
trying on a vessel, due to the pitching and rolling of the
ship; therefore in order to minimize these internal
forces, the entire cargo space is divided into 10 separate
oil-tight compartments. This sub-division, however,
with its numerous steel bulkheads, lends itself admir-
ably to the structural strength of a tanker.

As these new vessels represent an expenditure of close
to a million dollars, and required about nine months to
build, it follows that many hundreds of highly skilled
and qualified workmen were engaged in the construc-
tion. The allied trades directly associated with this
building programme included draftsmen, ship fitters,
welders, pattern makers, moulders, carpenters, joiners,
riggers, electricians, machinists, pipe fitters, plumbers,
blacksmiths, painters, and upholsterers. In addition
there were the sub-contractors such as the steel rolling
mills, where the plates and shapes are manufactured,
suppliers of electrical equipment and miscellaneous
machinery and fittings, railways, etc., all of which contribute their share towards the production of an
oil tanker.

After the vessels are finally completed in accordance
with the contract, sea-going trials will be carried out
and the performance of the propelling and auxiliary
machinery carefully observed. The ships will then be
placed in commission ready to take up their duties as
oil tankers.

While on the subject of oil carriers, it would not be
out of place to mention a few facts pertaining to the oil
burning vessels of to-day, that is, merchant ships of all
classes, equipped with steam engines and boilers and
now burning fuel oil in place of coal, irrespective of
internal-combustion engines which must of necessity
operate and depend entirely on oil.

In 1914 only 5% of the total tonnage afloat used
oil for boiler fuel. To-day 30% of the world's tonnage
is equipped with oil fired boilers, a strong testimony to
the many advantages claimed for this class of fuel. This
amazing increase is not due solely to the installation of
fuel oil outfits on new vessels, but also to large numbers
of existing steamers having been converted from coal to
oil burners. Ship owners all over are beginning to
realise the benefits to be gained by this change, which
is not surprising when one considers the remarkably
short time required to fill up oil burners compared to
the long and laborious task involved in the handling of
coal.

LAUNCHING MS "IMPERIAL"

At Collingwood, Ontario, on September 24th, a new
all-welded steel ocean-going tanker for the fleet of the
Imperial Oil Shipping Company Limited was launched.
The charming sponsor, Mrs. C. A. Eames, wife of Mr.
C. A. Eames, president of Imperial Oil Shipping Com-
pany Limited, broke the fully ribbed christening
bottle against the bow of the vessel and the MS
"IMPERIAL" slid backwards on into the waters of
Georgian Bay. See photo on page 10.

MS "IMPERIAL" takes the place of and is named after
a vessel which has been in our service for many
years. In fact, the old "IMPERIAL" was the first oil
tanker owned by Imperial Oil Limited and was, we
believe, the first oil tanker in Canada, having been
built in 1908.

At left, Mrs. C. A. Eames about to break
the traditional bottle of Cham-
pagne against the ship's prow.
The group included, from
left to right: J. H. Bal-
hvess, vice-
president and
manager and C. A. Eames,
president, Im-
perial Oil Ship-
ing Company
Limited; Mrs.
Eames and Mrs.
Balgren.