WIRE LINE

BPB

worldwide news & views number 5

Going with a Bang!

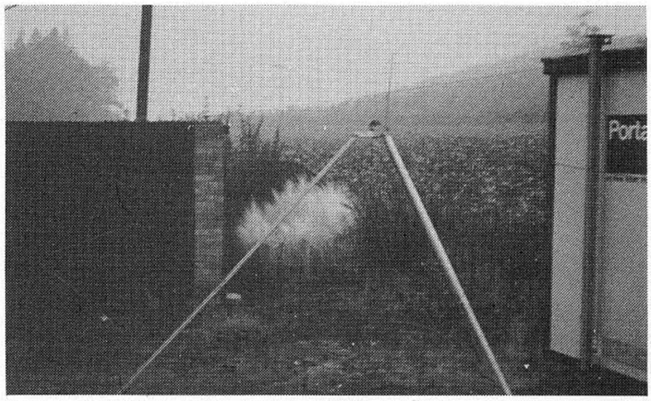
WIRE LINE likes to keep its audience informed on the latest developments in the company's logging equipment and services. After the head spinning complexity of the dipmeter featured in the last issue, it's quite a relief to describe something a little simpler, but in its own way, just as big a step forward.

What happens when you explode three pounds of gelignite down a hole in the ground? With any luck you just get a satisfying bang and avoid being covered in bits of flying turf. You also cause a fairly hefty shock wave. Like the wave from a pebble dropped into a lake that shock wave will spread out. In theory, the shock wave goes on spreading out from the original source for quite a while until it becomes totally undetectable. While you can still see the shock wave, though, you can discover interesting things about the medium it travels in by timing the gap between its departure from the source and its arrival at a second point, a known distance from the first. By travel time of the shock wave alone you could tell, for example, whether the lake into which you had thrown your pebble was composed of water or glycerin.

This basic technique formed the core of one of the first methods of geophysical investigation — seismology. Since their early days, seismic surveys have developed in complexity to become one of the most powerful tools in the exploration geologist's armoury. Along with most of the other exploration systems their complexity, sensitivity and accuracy have increased over the last decade or so. Relatively cheap micro-electronics combined with the push to exploit new mineral reserves have made more complete and intricate measurements standard exploration practice. Seismic surveys have now graduated to the status of an industry in their own right with a host of differing techniques each suited to a particular exploration job.

About two years ago BPB made its first steps into seismic exploration using sound waves as a measurement tool in the sonic log. The sonic log simply records the time taken for a sound wave to pass between a pair of detectors and converts the results into a sonde signal. The sound wave originates from a transmitter carried in the sonde. The arrival of each regularly timed sound pulse at a receiver starts an electronic clock which is stopped and set back to zero by the arrival of the same pulse at a second receiver a short distance above the first. The sonde section which houses transmitter and both receivers is built in a special plastic which has a low sound conducting ability and the transmitter/receiver array is placed so as to face the borehole wall. This arrangement means that the sound wave which is first to arrive at both receivers has travelled through the formation adjacent to the borehole rather than up the borehole itself or along the sonde. Interval times between the two receivers are directly related to physical properties of the rock in the penetrated section of formation such as particle size and compressability.

The simple sonic log is a good quantitative guide to the sound transmission abilities of the borehole rocks but, used in isolation, it cannot provide a full picture of lithology or the geomechanical properties of the strata. Until recently, the sonic sonde was used to round out information gained from other logs run in the same hole and to supply essential data for a computer assisted 'Strength Index' log, a composite of readings gained from sonic and density logs which are processed to produce a plot of relative rock strengths over a



A satisfying bang photographed at Kingston on Soar.

borehole depth. The arrival on the scene of a new BPB logging service, the Seismic Reference Survey, SRS, has changed the role of the sonic sonde.

The SRS itself is a small scale version of a simple seismic log. It consists of a downhole geophone array, mounted in a standard CCS sonde case, an airgun, medium powered but still quite spectacular in operation, a single timing geophone usually placed in the mud put beside the airgun, and a special set of uphole electronics. The SRS panel processes the sonde signal and triggers the airgun and an ultra violet recorder produces the sonde reading in a permanent form. The ultra violet recorder, which as its name suggests, uses ultra-violet light sensitive paper and focused U-V bulbs instead of pen and ink, is employed for two reasons. The first is that the SRS measurement is simply a recording of the 100-500 milli-second interval between the sound wave from the airgun reaching the pit geophone and its arrival at the downhole geophone. It is very difficult to get a normal pen and paper recorder system to respond with that speed to an intermittent signal, so rather than having metre after metre of unused log paper, the U-V recorder is set to run at a particular speed, accelerated in the short interval between the pressing of the 'FIRE' button on the SRS panel and the triggering of the gun, and then automatically cut-off after running out a short, pre-selected, length of paper containing the traces from the sonde geophones. The gun is actually triggered by the recorder's reaching the pre-set speed, usually 1 metre per second. This arrangement has the advantage that on the finished recording, the U-V paper's grid lines can be set to represent precise elapsed times. So with a five millisecond gap between each of the grid lines, timing the arrival of soundwaves at the geophones is simply a matter of totting up the grid lines between the signal recordings. Which brings us directly to the second advantage of a U-V recorder over the normal pen and paper arrangement. The geophone signals are not simply on/off recordings. Geophones work very much like standard microphones, and what they actually 'hear' as a result of the airgun explosion, is, like the shock wave from our old friend, the dropped pebble, a large initial wave front, followed by a series of diminishing secondary waves. It is important to time the arrival of the first wave front, each time the gun is triggered, since the standard interval being measured is that between the first arrival at the pit geophone and the first arrival at the downhole geophone. Although it is possible to obtain pen recorders which are capable of producing a clearly visible track of first and subsequent wave fronts, the U-V recorder is a more practical and less delicate alternative.

Once the airgun and electronics are set up for the log, running SRS consists simply of moving downhole to each of the pre-selected depth stations and stopping the sonde, slackening off the cable to minimise transmitted noise, then firing the gun at each station. The series of interval times which results from this operation are usually tied in fairly closely to the lithological changes over the borehole depth. Average transit times from the gun to the downhole geophones are obtained for each major change in rock formation, those changes usually deciding the depths at which measurements are taken. And the end result, once the times have been calculated from the recorder output, amounts to a sonic profile of the rocks down to the full depth of the borehole, similar in content to the complicated computer assisted seismographs currently used in surface based exploration.

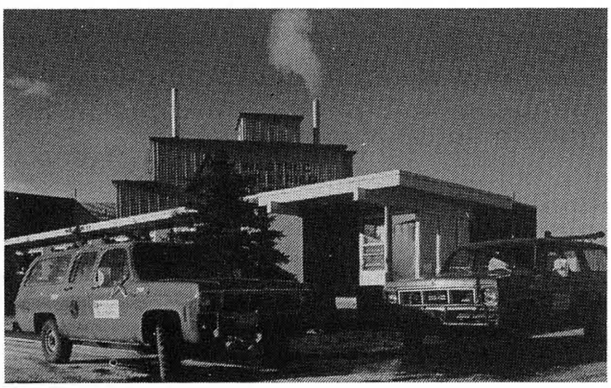
Field geologists can relate BPB's SRS results to their own surface seismic surveys, making more detailed information available from both sets of results by the comparison. But the main advance which SRS makes possible is in the interpretation of the data from sonic logs. SRS gives a basic average transit time measurement for a large section of a formation and the sonic log provides a continuous measurement for a comparatively small section of rock around the borehole.

The detailed information available from the sonic log only gains a general application to the local lithology when combined with bulk rock measurements, as in the 'Strength Index' produced with the aid of a bulk density log. SRS provides a set of base measurements for individual strata against which the small changes in the sonic record can be interpreted with a new clarity. Together, the two logs can provide almost as complete a seismic record as the sophisticated equipment used in oilfield exploration. And they represent BPB's first steps into a new technology — the seismographic survey.

The Frozen North

BPB Instruments (Canada) Ltd. is one of the company's oldest overseas outposts. It is also the largest of the company's logging operations in terms of personnel, a position it shares with SAF. With a touch of romance leant by distance, WIRE LINE is sure that BPB's Canada base has two further indisputable claims to fame. Of all the 'character building' experiences offered by logging bases, a Northern Canadian winter, judged on severity alone, must be the most successful. And of all the inaccessible, difficult and positively frightening drilling locations reached by company engineers, the Northern Rocky Mountains provide some of the most 'picturesque'.

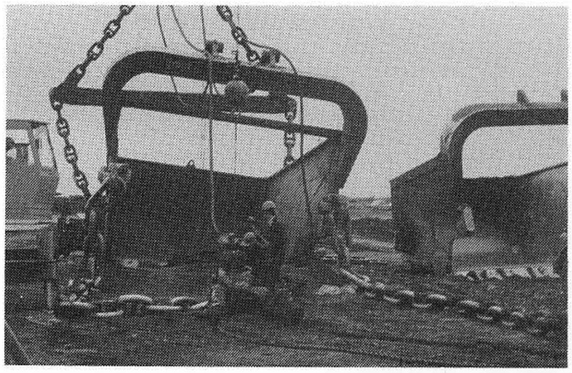
BPB Instruments (Canada) Ltd. 'CDN' or just 'Canada' to the folks in the U.K., is composed of two very different logging bases, Calgary, at the foot of the Rockies, and Fredericton, New Brunswick, over in Eastern Canada and nearer to East Leake than to Calgary.

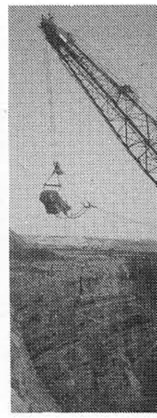


Calgary Headquarters

Fredericton is the younger of the two centres having started up in early 1977 with a single logging unit then based in Moncton about 150 miles from the present address. New Brunswick state is only at the start of a programme of development for its mineral resources and BPB's main involvement there has been in strictly exploration work, government backed geological surveys and potash, salt and uranium exploration for a small number of private companies. Although not as yet a rich source of logging jobs, Eastern Canada has proved a rich source of loggers — almost half of CDN's personnel come from there. In Canada 'go west young man', still has a lot of its nineteenth century promise of adventure, fame and untold wealth. Alaska,* the Yukon Territory and Alberta have all been enjoying a mineral boom richer than anything dreamt of by the pioneer gold prospectors of a century and a half ago.

**Alaska is now one of the United States, it was once part of Russia and, as any fool can see, it's always been part of Canada.*





The mosquitoes at Fort McMurray came slightly smaller than the draglines, thank goodness!

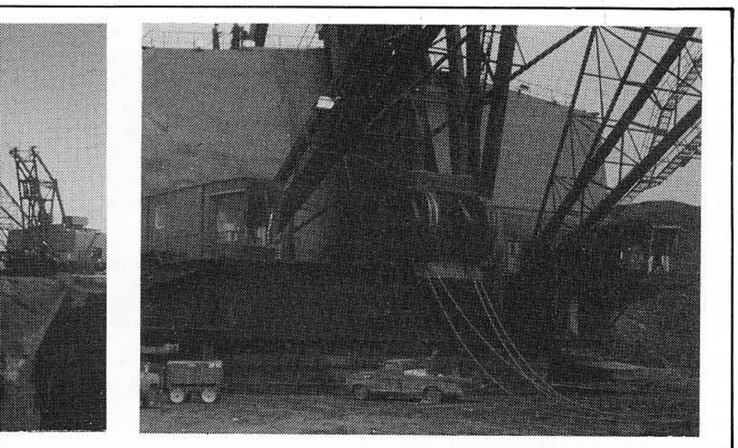
On the Southern fringe of the boom area lies Calgary, home of the famous 'stampede'. Right beside the Calgary Stockyards is the first destination of the young men who went West with BPB, CDN's main office on the Westroc site. Unlike Eastern Canada, Calgary's logging work is almost exclusively connected with coal and oil production, most of which is going on to the North of Calgary. Our engineer's next destination is therefore likely to be somewhere around Grande Prairie, where a number of companies are exploiting Alberta's thermal coal reserves. Large coalfields extend from the British Columbia border at the foot of the Rockies down through Edmonton and Calgary into the plains and wheat country of Saskatchewan to the South East. High grade steam coal deposits in the Eastern cordillera of the Rockies attracted a number of coal companies over the state boundary into British Columbia in the mid-seventies and BPB still operates three logging units from Chetwynd, North West of Calgary and one unit from Sparwood, South West of Calgary, both in British Columbia. As you might expect, logging from CDN bases is 'very seasonal', i.e. subject to large changes in workload from winter to summer. Although South East British Columbia around Princeton has a mediterranean climate, most of Alberta manages a hefty six to eight month winter with temperatures in the region of -20 to $-40°C$, at least part of the time. Bracing winters mean that to reach some of the mountain drill sites in the North of our operating area would need a miracle, rather than just the large dose of good luck which, if you have nerves of steel, an acrobat's sense of balance and timing, and a near total disregard for your own health, will usually get you over the area's 'roads' in the summer. Most drilling operations in the mountains close down over the winter but, when the freeze has properly set in, the 'muskeg' marsh, which underlies all those thousands of square miles of pine forests in the foothills and on the Northern Plains, becomes decently navigable for a couple of months on either side of the really cold season. Drill rigs, thanks to the frozen marsh, can reach some of the more uncivilised lowland coal prospects. So, although most of the CDN's logging jobs occur in May, June and July, and the weather does have a considerable effect on what happens where and when, 'very seasonal' does not necessarily mean that logging stops entirely during the winter.

The mineral boom which made Alberta a contender for the title, to be awarded in 20 years or so, 'The Last Place on Earth with its own oil', has brought some interesting projects for the

Calgary base. Among the most notable must have been the logging programmes the company undertook for Syncrude at the Fort McMurray Tar Sands, the 'dirtiest job in the world', to quote a frequent visitor to that far flung outpost.

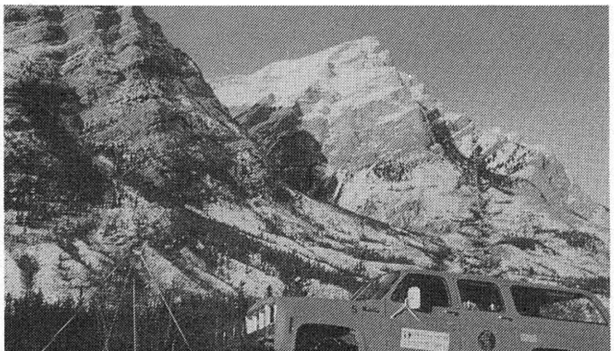
With the recent vast increases in oil prices reserves which were previously uneconomic to exploit have become viable. Alberta houses the Athabasca Tar Sands, potentially one of the Earth's largest oil reserves, as well as one of the most expensive to exploit.

Oil is simply the biological debris from millions of small sea going animals and plants. Over a vast period of time it collects, by percollating through the sandstone in which it was formed into ever larger areas of oil saturated rock. Extracting it is simply a matter of tapping into the oil soaked rock at a point where hydrostatic pressure will force the oil up and out of the oil well like water from a sponge. There are some places where, unlike say, the North Sea, the oil is relatively easy to get at, but, because of its chemical composition and the



mechanics of the geological formations which contain it, extracting the stuff is not simply a matter of drilling a hole and waiting for a 'gusher'. Basically, the oil will not gush. The problem of getting oil to the surface and out of the sandstone in which it has formed, is what makes this type of oil expensive. Sometimes the difficulty is overcome by pumping water or steam into the oil bearing sand via one borehole and sucking the heavy oil out via another. Sometimes these tar sands lie fairly close to the surface, as in parts of Northern Alberta, and rather than pump the oil out, it is simpler and cheaper — building the Syncrude plant cost only $2 billion in 1977 — to mine the sand with its cargo of heavy oil and use a specialised chemical plant to produce clean sand and a substance known as 'Synthetic Crude'.

The Syncrude consortium, a world leader in this type of oil production, opened Canada's biggest 'oil mine' about 40 miles North of Fort McMurray in Alberta in 1977. The mine should produce 125,000 b.p.d. (barrels/day) of synthetic crude for chemical plants at Edmonton, when it is in full production and its reserves should last for 20 years. The site is typical of Northern Alberta — miles of subarctic pine forest underlaid with 'muskeg', the local term for the bogland which fills the gaps in the mounds of glacial deposits left after the end of the last ice age. The end of the last ice age can seem to be quite recent when Fort McMurray's winter temperature drops below −40°C.



We will log them in the mountains . . .

Extremes of climate, summer temperatures reaching 35°C and above, are no barrier to the mining operation. Although the tar sands are quite close to the surface geologically, quite a lot of glacial till has to be removed before they are reached. In fact, the four draglines in use on the project shift more material in a year than all the rest of Canada's mining operations put together! Even though the scale of the job is vast the technique is a fairly standard one used in Stripmines all over the world. Two dragline excavators work in a pair to dig an oblong trench, and, moving backwards on hydraulic 'feet', they create a pair of spoil heaps. Bucket wheel excavators, conveyor belts, bulldozer tractors and trucks move the spoil heaps to either the chemical refinery or, if they contain no oil, to a storage heap where they will be combined with the clean sand from the refinery and used to fill in old workings. When the draglines come to the end of their first trench, which is now a single deep cut in front of them, they are moved sideways away from each other and then they repeat the operation, moving in the opposite direction and widening the trench.

BPB's logging programmes on the Syncrude site had two aims. The geology of the site consists of a layer of limestone overlaid with water saturated sand, shale and clay; above the water bearing formations lie the tar sands with their covering of glacial till and muskeg. When the tar sand and glacial till are removed from above the aquifer, the water it contains will, in the normal course of events, break through to the surface, flooding the pit. Unless the ground water pressure is relieved a problem known as 'basal heave' will arise before the flooding stage. 'Basal heave' is simply the bottom of the pit being pushed upwards by the water pressure from the underlying strata. BPB's first logging programme was aimed at locating the boundary between the aquifer and the tar sand so that dewatering operations, aimed at preventing basal heave, could be efficiently planned.

The second logging programme was also preventative. The draglines, in normal operation, are sitting on a corner of land, surrounded on two and sometimes three sides by the tar sand trench. The vast weight of the machine resting on the unsupported rock faces could cause the ground under the dragline to slide down into the pit it is digging or into the finished workings beside it; the dragline would, of course, follow the ground as it slid the 180' down to the bottom of the slope. The aim of the second logging programme was to help prevent this type of catastrophe by picking key locations in the workings where installations to monitor formation movements would be best sited.

. . . and on the plains.

BPB crews working on both programmes came back thoroughly impressed by the size of the mosquitoes which plague the site in summer and the size of the equipment Syncrude were using to mine the sands.

Why 'the dirtiest job in the world'? Two reasons. To reach the boreholes engineers were obliged to drive around areas of muskeg on roads already ground to a whipped cream consistency by the passage of site vehicles. This provided even the most carefully driven logging unit with an overcoat of mud, dust or iced slurry, depending on the season. The real dirt was encountered at and around the boreholes, many of which were on the floor of the mining trench. The ground there and around the dragline itself consisted of a layer of tar sand; tar sand smells, it sticks to everything and has a consistency somewhere between those of half melted macadam road surfacing and Brighton beach when the wind has been blowing an oil slick in its direction for a few days.

Combing tar sand out of your hair for the third or fourth day in succession convinces you that logging at Syncrude is probably amongst the dirtiest jobs in the world.

Not content with the difficulties presented by some of the logging operations, Canadian engineers seem bent on making life harder still. Chris Mothersele, the present Centre Manager, holds some sort of record in this respect. His claim to fame rests on the number of logging operations he managed to complete with a kitchen liquidiser firmly tucked under his arm. A skiing accident had left him with a broken jaw and, while it healed, he was obliged to eat through a straw. Rob Hyde, who managed the Centre from 1976 until Chris took over, and who supplied WIRE LINE with information for this article, was as pleased as Chris himself when the jaw healed. The prospect of anyone putting a steak dinner, garnish and all into a liquidiser and then drinking the result was nearly as bad as being obliged to do it yourself. Rob did have his own claims to logging fame. When he first went to Canada for six months in 1973 he had the honour of being the engineer in charge of the only radiation panel logging unit ever to be destroyed by an enraged pine tree. The unit was mounted on the back of a tracked 'bombadier', the ideal vehicle for driving through the half-liquid muskeg, capable as it was of negotiating rotting tree stumps, undergrowth and fallen logs. On the day of the accident Rob drove the bombadier into a log which was not quite as fallen as most; the tree, anchored by its roots, bent like a bowshaft, slid up the front of the Bombadier and whipped across the rear of the vehicle, demolishing part of a logging unit on its way. Other engineers have their problems too. Richard Bishop, for example, holds the BPB Canada record for flat tyres. His vehicles had a habit of losing tyres miles from civilisation, so far from civilisation that, on one occasion, he had to ask the radio telephone operator to take a fix on his signal and tell him where he was, before he could ring a breakdown service for his truck which had blown its spare.

Although Calgary itself has a population of 550,000 and 1,500 people per month settle inside its sprawling 400 sq.ml. boundary, there are vast areas within fairly easy driving distance of both it and Edmonton which are totally unspoilt, i.e. they contain nothing but trees and the occasional logging engineer with a flat tyre. Enjoying the outdoor life is the main leisure occupation of the native Albertans; English, Scots and middle European stock with, thanks to the mineral boom, a high standard of living which extends to a mobile home in most garages. Organised social life is relatively expensive, so BPB engineers tend to stick to skiing as a recreation, quite possible since the season lasts from October to May, rather than joining golf, squash and tennis clubs. Alberta's drinking laws play havoc with the Englishman's taste for his local hostelry. Being relatively recently developed most of Calgary has been subject to strict zoning regulations and, since Albertans have a somewhat Puritan turn of mind, all the bars are downtown away from residential areas. Even when you find a bar, chances are you'll queue to get in because lounge bar law says you must be served with drinks only when seated at a table and, if the house has no spare tables, customers queue to wait for the first free one. A system not to the average English logger's taste at all, especially since Alberta's authorities are possibly the keenest people in the world on the dreaded breathalyser; a drive downtown, an hour waiting outside a bar, an hour drinking, followed by three hours waiting in a traffic jam to be breathalysed is not quite the recipe for a perfect night out.

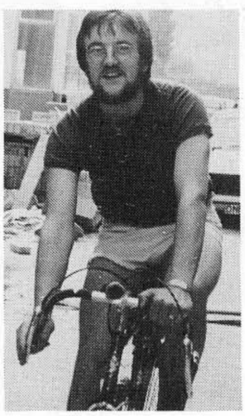
You might say that the ex-patriot staff in Calgary have to work hard and play hard in more ways than one.

Where are they now?

WIRE LINE's occasional roundup of people with incorrectly spelt names living in faraway places appears again in this issue. All the assignments noted below date from mid-August so some engineers may find themselves now listed on the wrong centre's staff. WIRE LINE promises to start a problem page in its next issue especially for all those individuals who are both mis-placed and mis-spelt!

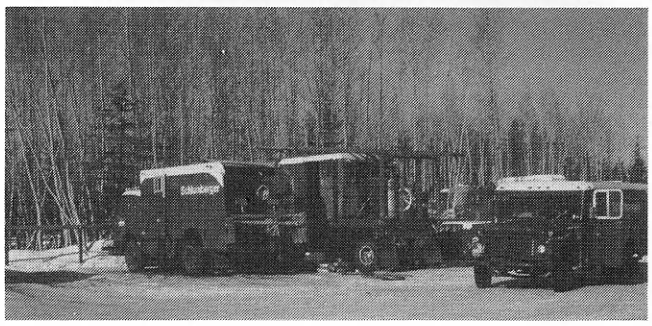
UKL	CDN	AUS	SAF	USA (E)	NZ & LEAVE
I. Dison	C. Mothersele	C.C.F. Williams	E. Hulatt	G. Grace	P. Rees
N. Reade	D. Fisher	R. Butt	J. Harvey	A. Reynolds	P. De La Mare
N. Powell	R. Bishop	N. Waddoup	S. Schlesinger	P. Waters	M.J. Chaplin
R. Turner	D. Gorman	S. Morecroft	M. Lagowski	M. Birch	
R. Williams	D. Wark	D. Mylrea	J. Towers	M. Ward	
C. Robinson	K. Nazim	M. Howard	S. Willsher	C. Donahue	
P. Wilson	D. Roy		L. Brown	W. Elles	
D. Firth	D. Reed		R. Weihmann	G. Angermeier	
P. Sands	M. Ryan		M. Dearlove		
A. Spencer	P. Stedman		I. Donkin	**USA (W)**	
P. Charnaud	P. Maxwell		E. Kohler	M. Seal	
R. Askew				E. Marshall	
N. Harvey				K. Goodhew	
R. Barrer				J. Butler	
P. Matthew					

On Your Bike



WIRE LINE's response to the summer's petrol crisis demonstrates that at least one European is taking Jimmy Carter seriously. Since your editor's expense account did not run to the same tactic for avoiding petrol price rises used by almost every other magazine editor in the world — taking a cab — he bought a bicycle in an effort to stave off the effects of the energy crisis. No one told him that halfway through his twelve mile journey home five nights a week he would be privileged to experience his own personal energy crisis. Anyone with a spare pair of legs, preferably in good condition is asked to contact the WIRE LINE office — urgently.

Having Problems?



WIRE LINE's Roving Camera in the shape of Malcolm Cherrie spotted these three logging units in Northern Canada. Despite the fact that the picture was taken quite some time ago, it does go to show that even the most renowned logging companies occasionally fall foul of Murphy's Law. Anyone with a suggestion as to why all three trucks have gathered together should write to WIRE LINE. Centre Managers anxious to impress prospective clients please note that a framed enlargement of the photograph will be sent to adorn the winners office wall.

WIRE LINE invites copy from all BPB Instruments employees, wherever they are based. Its resources are limited and, unless it gains the support of overseas bases, it will become a magazine dominated by activity at East Leake. Please send any photographs or stories which you would like to see in the next edition to the Technical Author at East Leake. Subject matter does not have to be work oriented — WIRE LINE hopes to make its pages as full of variety and interest as the characters and interests of the people who form the Company.

BPB INSTRUMENTS Ltd., East Leake, Near Loughborough, Leicestershire, England.