

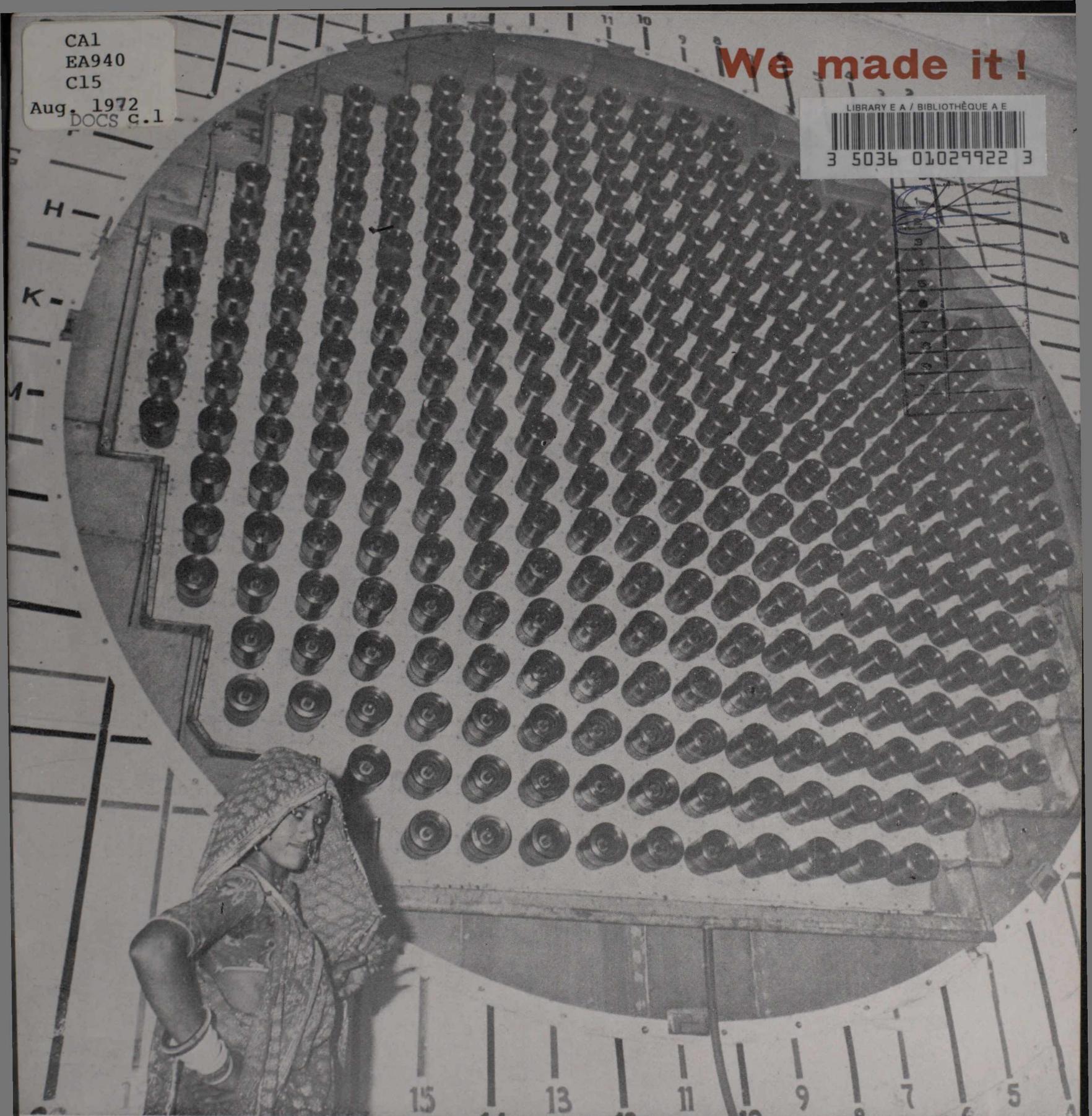
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New Delhi, August 1972

CANADA

LETTERS

Sir,

I agree that the magazine should be geared to the interests of Indian friends reading it, but is there still not a place for letting people know what is being done in India by Canada? I know very little about Canadian aid to India, or about projects which are sponsored jointly by India and Canada, other than the information in your magazine. This makes me wonder how many Indian folk are aware of cooperation between India and Canada. No doubt those living in large cities and in touch with good news coverage are well informed, but this must apply to a small proportion of potential readers. It has been my experience that those in this area are much encouraged when they realize that those of other countries are concerned and interested in their welfare. I hope that it will be possible for your magazine to continue to depict something of what Canada "shares" as well as what Canada "has."

Yours etc.,
Kathleen Metheral.

Hat Piplia, M.P.

Sir,

We would suggest that more emphasis must now be laid in your periodical on the social, cultural and economic life of the Canadian people so that we may understand and better appreciate the common problems facing us and the common links and ideals existing between our two countries. We expect CANADA magazine would prove a window to your country through which a channel of Indo-Canadian friendship flows and the two great countries work together for peace, progress and prosperity in the world.

Yours etc.,
O. P. Sharma.

Jammu,

Sir,

The June issue of your magazine is informative and good reading. I

have noted the shift in emphasis from Canadians in India to Canadians at home. That was necessary. Maybe you will some time come out shedding ample light on Canadian Indians: their ways of life; the impact of modernism on their Indian culture; and the existence of pundits, purohits and temples in Canada. Maybe you will some time also tell us why Canadian intellectuals are so enamoured of Indian Vedanta and Tantrism.

Yours etc.,
H. P. P. Soham.

Datia, M.P.

"Enamoured" is the word, but it wouldn't apply to Canadian intellectuals in general.

Sir,

The June issue of CANADA magazine, which I have gone through from cover to cover, is very interesting and gives a foretaste of what your shifts from Canadians in India to Canadians at home involves. It is really an amusing essay to present Canadian problems to the people in India and awaken their consciousness to similar problems in this vast country, developing as it is into industrialism of today and tomorrow. The themes dealt with are only a fringe of the themes daily life presents socially and culturally, economically and environmentally. No special theme should be emphasized. There is philosophy, there is science, there is education; there is the student and his indiscipline, the child and his health, the grabber and the grabbed. I would only like a side-by-side correlation with India to arouse the Indian's interest in knowing the Canadian and his Canada better.

Yours etc.,
J. L. K. Jalali.

Srinagar

Sir,

The June issue of CANADA offers to its readers three brilliant studies in contrast; and each of them tells a tale of change that is imperceptibly taking place not only in Canada but in India as well as in all developing countries. The articles show great excellence

both in description and narration; and are highly suggestive and critical. Among the journals issued by the embassies CANADA strikes new ground; and this particular issue has come as a pleasant surprise. Readers will look eagerly forward to further issues. Contrasts in culture, language and people may be as usefully presented as in this issue in which such impressive word pictures have been painted of things that were and are to be.

Yours etc.,
L. K. Govindarajulu.

Cuddalore.

Sir,

Personally I have liked the change, because in this way we shall be able to know something about the current problems of your great country and particularly those problems that have their counterparts in India. Here are some subjects which you might perhaps like to handle:

University education in Canada

Is there any youth problem in Canada?

Problem of unemployment in Canada
Rising prices

Democracy in practice in Canada with special reference to the role of opposition parties in Parliament

Place of woman in Canadian social and political life

Are socialistic ideals welcome in Canada?

Yours etc.,
I. S. Kohli.

New Delhi.

Readers are invited to submit their views on the contents of CANADA magazine and on Indo-Canadian topics in general.

—Editor

COVER: One of the Labourers who worked on the site poses against the north end of the RAPP I Reactor Core (See Page 7).

THE PEACEABLE KINGDOM

One Man's Canada

Excerpts from the Introduction to William Kilbourn's *Canada: A Guide to the Peaceable Kingdom*. The writer is a professor of humanities at York University, Toronto, and author of several histories.

The title of this book was chosen to suggest that it would serve as a travel companion for explorers of the Canadian spiritual landscape. But the title also hints at something else: the astonishing notion that this two-cultured, multi-ghettoed, plural community, this non-nation, this wind that lacks a flag, this Canada of ours, might be a guide to other peoples who seek a path to the peaceable kingdom. The child of nations, giant-limbed, as Sir Charles G. D. Roberts called it back in Laurier's day, may even have grown up, no longer ungainly, no longer immature, ready at last to be a father to a few of the world's lost and abandoned children and a brother to all mankind.

In the 1970's there is a new urgency to Canadian nationalism that it did not possess before. Things have changed so fast, so recently. In the past to be a patriot in Canada has often been a bit pointless—as official as a Centennial Commissioner, as silly as that hundred-per-cent CBC listener whose favourite program was the Dominion Observatory Official Time Signal. The new

sense of conviction and purpose to Canadian nationalism derives in part, of course, from strong feelings about the direction of American society. These feelings certainly add substance to the new radical attack on United States economic domination, and to Jane Jacob's plea for us to preserve Toronto and Montreal from the fate of the American metropolis. They add an extra poignancy to Joyce Wieland's pastoral vision of Canada in her film *Rat Life and Diet in North America*.

The basic experience of Canadian history has been that of sharing the northern part of the continent with the other, larger America. Everywhere in the twentieth century man is becoming American, or, to put it another way, is moving in some way towards a condition of high industrialization, affluence and leisure, instant communication, an urban man-made environment, and a mingling of cultures and traditions in a mobile, classless global society. There is no country in the world, except the United States, which has gone further in this direction than Canada; none that has done so in such an American way; and none that is

so experienced in the art of living with, emulating, and differing from the United States. If Canadians (and perhaps others) wish to explore the real freedoms open to them in such a society and to escape the blandness and boredom, the sameness and despair latent in such a brave new world, they could usefully examine the subtle but profound ways in which Canada differs from the United States. For what emerges clearly to me is that Canada is a different kind of American society, an American alternative to what has happened in the United States.

When William Van Horne gave up his American citizenship after completing the C.P.R., he is said to have remarked, 'Building that railroad would have made a Canadian out of the German Emperor.' The inexorable land, like the Canadian climate, has always commanded the respect of those who have tried to master it. It is simply overwhelming. Except in small pastoral slices of southern Ontario and Quebec, the original wilderness of bush

→
Reprinted by permission from Canada: A Guide to the Peaceable Kingdom (1970 Macmillan of Canada, Toronto).

or prairie presses close to the suburban edge of every Canadian town. In summer the boreal lights, a shaking skyful of LSD visions, can remind the most urban of Canadians that they are a northern people, that winter will bring again its hundred-degree drop in the weather, and that their wilderness stretches straight to the permafrost, the ice pack, and the pole.

Nature dreadful and infinite has inhibited the growth of the higher amenities in Canada. The need to wrestle a livelihood from a cruel land has put a premium on some of the sterner virtues—frugality and caution, discipline and endurance. Geography even more than religion has made us puritans, although ours is a puritanism tempered by orgy. Outnumbered by trees and unable to lick them, a lot of Canadians look as though they had joined them—having gone all faceless or a bit pulp-and-papery, and mournful as the evening jack-pine round the edges of the voice, as if (in Priestley's phrase) something long lost and dear were being endlessly regretted. Or there are those who run—by car, train or plane (flying more air miles per capita than any other people), lickety-split as if the spirit of the northern woods, the Wendigo himself, were on their trails. Nature has not always been an enemy, but she has rarely been something to be tamed either. At best we have exploited her quickly and moved on. No wonder the atmosphere of our towns still often suggests that of the mining camp or the logging drive, the trading post or the sleeping compound. If transportation has been crucial

for Canada, and our main-street towns attest the worship of train and motor car, then communications (more telephone calls than anybody else), particularly radio and television (the world's longest networks), have been vital. It is no surprise when some of old Rawhide's Canadian characters become so addicted to the telegraph key that they can only talk in the dah-dah-dits of Morse code.

But Canadians have also learned to live with nature and derive strength from her. It is not just the Group of Seven who came to terms with her terrible grandeur. From the first military surveyors and the C.P.R. artists down to the abstract expressionists of post-modern Toronto, our painters have been profoundly influenced by the Canadian landscape. 'Everything that is central in Canadian writing', says Northrop Frye, 'seems to be marked by the imminence of the natural world'. The American critic Edmund Wilson sees the most distinguishing feature of Hugh MacLennan's work as the unique way he places his characters in 'their geographical and even their meteorological setting.' Our historians do not argue about the amount but the kind of influence geography has had on our history—whether it has been the north-south pull of North American regionalism or the east-west thrust of the St. Lawrence and Saskatchewan river systems and the Laurentian Shield.

Precisely because life has been so bleak and minimal for so long in so much of Canada, the frontiers, far more than in the United States, have been dependent on the metropolitan

centres of Toronto and Montreal and Europe. A visitor to pioneer Saskatchewan in 1907 remarked at the strange sight of a sod hut with a big Canadian Bank of Commerce sign on it, open for business. The essence of the Canadian west is in that image. Organized society usually arrived with the settlers or ahead of them—not only the branch bank manager, but the mounted policeman and the railway agent, the missionary and the Hudson's Bay factor. Dawson City at the height of the gold rush had its sins and shortcomings, but even here lawlessness was not one of them. Violence and terror do not yet stalk the subways or the streets of darkest Toronto.

Among peoples as different as the Metis and the Doukhobors, the community and its custom was the dominating force in western settlement. Even the most self-reliant Protestant pioneer in Canada West or Alberta was never quite a Davy Crockett or a Daniel Boone. From the founding of the Hudson's Bay Company in 1670 to that of the C.P.R. and the dozens of modern Crown corporations, the large, centrally planned enterprise, dominating its field and supported by government regulation, has been typical of Canadian development. As the historian William Morton says, Canada, in contrast to the United States, is founded on the principle of allegiance rather than social contract, on the organic growth of tradition rather than on an explicit act of reason or assertion of the revolutionary will. The B.N.A. Act sets up the objectives of peace, order, and good government, rather than

those of life, liberty, and the pursuit of happiness. The fact and principle of authority is established prior to the fact and principle of freedom. In the British tradition of monarchy, parliament, and law, specific liberties are carved out within the ordered structure of society.

There is in Canadian political, business, and social life a certain formality and conservatism that reflect this fact. This conservatism has its regrettable side, of course. The walking dead are out in numbers—the mediocrats, the anti-hothead vote. We are 'the elected squares' to one writer and 'the white baboos' to another; for our inefficiencies there is no excuse. A little talent will get you a long way in an uncompetitive society, protected by tariffs and government rewards. A Canadian has been defined as somebody who does not play for keeps. Even his anti-trust laws fail to enforce business competition as ruthlessly as the American ones.

The Canadian, unlike the Frenchman, the Britisher, or the American, has had no single dominant metropolis. The English-speaking Canadian has had New York and London as well as Toronto and Montreal, and for the French Canadian there has been Paris as well. This condition breeds a divided vision, sometimes paralysing, sometimes detached and ironic, always multiple, and useful for living in the electronic age's global village. It has meant that Canadians have been better interpreters and critics of culture than creators of it—better as performing musicians and actors, for example, than as composers or

playwrights. In politics and diplomacy this has led to an extreme pragmatism. Our two major parties are even less the preserve of one class or doctrine than the American parties. Certainly there has been nothing like the Republicans' monopoly of the rich and of the free-enterprise creed. There are no strong ideological overtones about this Canadian approach to other peoples and world affairs.

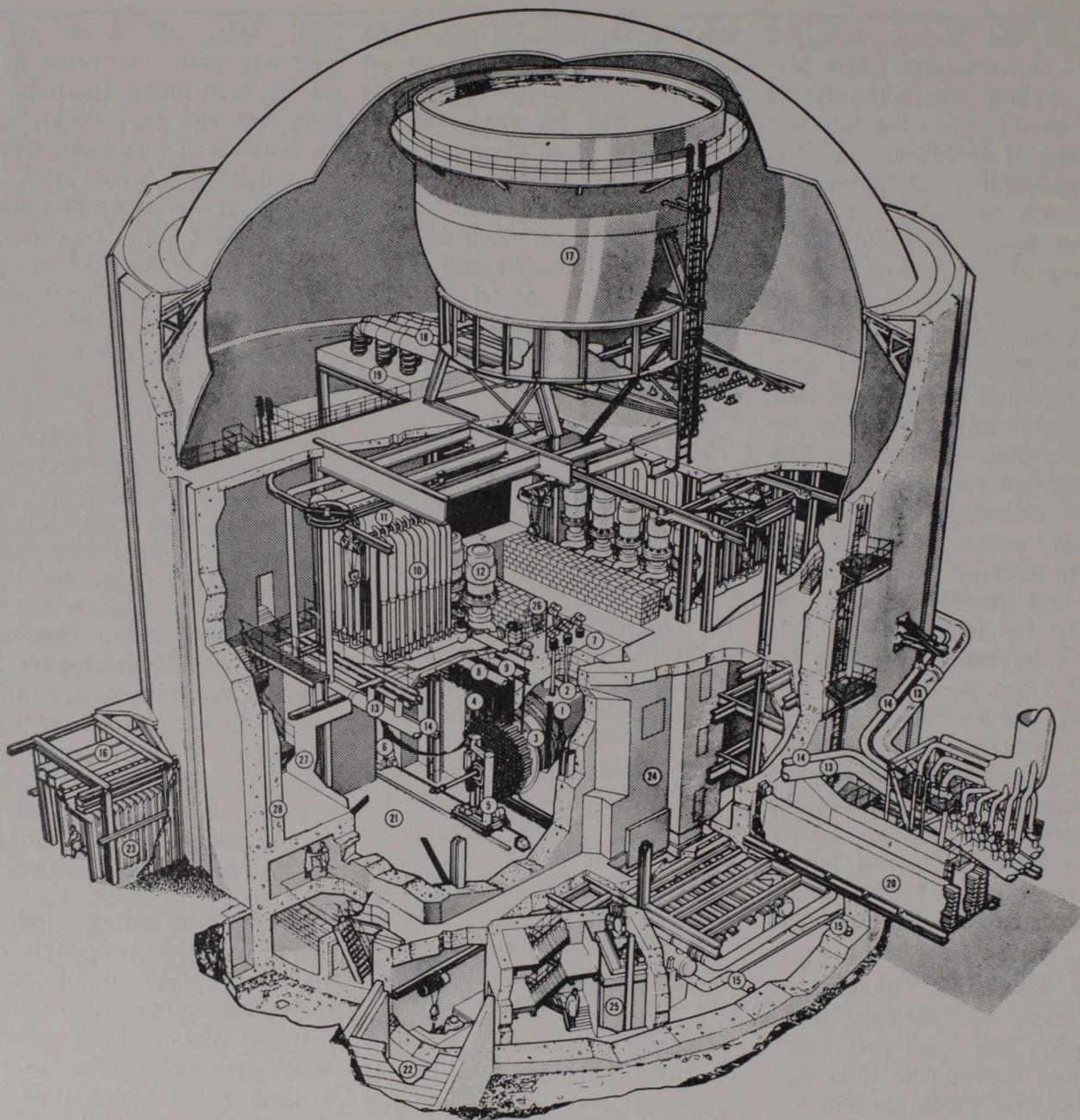
When a distinguished American advocate of socialism, pacifism, and free love was turned back by Canadian immigration authorities in 1965, the liberal governor of Minnesota deplored this unexpected evidence of McCarthyism in Canada. It was of course nothing of the kind. In a sense, it was just the opposite—an almost touchingly stupid application of the letter of the law, born of respect for regulations. There was little real concern about doctrines. In Canada ideas abound and rebound with Hindu proliferation, and except among some French Canadians are not taken very seriously anyway.

Canada is a place not easily confused with paradise or the promised land. This 'indigestible Canada,' this Marx Brothers' Freedonia, this Austro-Hungary of the new world, with its two official peoples and its multitudes of permitted ones, its ethnic islands and cultural archipelagos, its ghettos of the unpasteurized and unhomogenized, this harbour of old Adams unable or unwilling to be reborn or to burn just yet their old European clothes, but growing attached, many of them, as deeply as the Indian or the pioneer to the landscape of farm and city—this Canada

has, alas, not even carried diversity and toleration nearly as far as it might (perhaps lest they become principles), since in practice it has been extremely difficult for Asians and West Indians to immigrate to Canada. By contrast, one conjures up a hopeful vision of the year 2070 in which the majority of Canadians will be of Chinese origin—though the ones that speak English, who will be called 'Anglo-Saxons' in Quebec, will undoubtedly have their quarrels with those who speak French, some of whom will be unable to get their children taught in French in British Columbia.

Canadians often apologize for or feel guilty about the lack of revolution or civil war in their history to stir up their phlegmatic souls. The poet James Reaney recalls someone at a cocktail party sneering at one of the Riel rebellions because so few people were killed.

In a world where independence often arrives with swift violence, it may be good to have one nation where it has matured slowly: in a world of fierce national prides, to have a state about which it is hard to be solemn and religious without being ridiculous, and impossible to be dogmatic. In a world of ideological battles, it is good to have a place where the quantity and quality of potential being in a person means more than what he believes: in a masculine world of the assertive will and the cutting edge of intellect, a certain Canadian tendency to the amorphous permissive feminine principal of openness and tolerance and acceptance offers the possibility of healing. ■



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|--|--|-----------------------------|---------------------------------|
| 1 CALANDRIA | 8 PRIMARY HEAT TRANSPORT
HOT HEADER | 13 STEAM HEADERS | 21 FUELLING MACHINE VAULT |
| 2 HELIUM LINE | 9 PRIMARY HEAT TRANSPORT
COLD HEADER | 14 BOILER FEEDWATER HEADERS | 22 SPENT RESIN STORAGE |
| 3 END SHIELD | 10 STEAM GENERATORS | 15 PROCESS WATER INLETS | 23 MANWAY |
| 4 PRIMARY HEAT TRANSPORT
SYSTEM FEEDERS | 11 STEAM DRUM | 16 VENTILATION DUCTS | 24 LABYRINTH |
| 5 FUELLING MACHINE | 12 PRIMARY HEAT TRANSPORT
SYSTEM MAIN PUMPS | 17 DOUSING TANK | 25 ELEVATOR |
| 6 CABLE CART | | 18 DOUSING TANK PIPES | 26 THERMAL SHIELD COOLING DUCTS |
| 7 BOOSTER RODS | | 19 SPRAY TANK | 27 BLOWOUT PANEL |
| | | 20 CABLE TRAYS | 28 PRESSURE WALL |

This is a cutaway view of in 1975, will be an almost exact Canada's Douglas Point nuclear copy. The nuclear power plant being built at Kalpakkam, Tamil Nadu, RAPP II, scheduled for completion will be based on the same design.

The first unit of the Rajasthan Atomic Power Project went critical at 11 a.m., August 11.

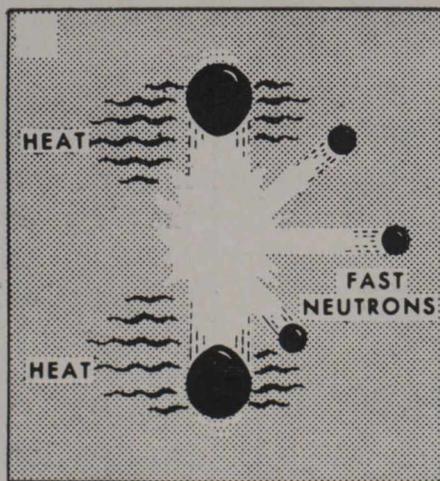
THE AIR hold test of the moderator system was relatively simple. Air at five pounds per square inch was pumped into pipes connected to the calandria. Then they introduced some helium into the system. The presence of helium can be detected by a special instrument, a mass spectrometer which can sense leaks of the order of 1 cc per year. When the joints and valves in the moderator system passed that test, the system could be tentatively deemed tight.

When the air hold test of the heat transport system started towards the end of May the entire pipe system had already been "hot" conditioned. Both the moderator and the heat transport systems had been in full operation for more than two weeks, using ordinary water. That built up a layer of black magnetic iron oxide on the inside of the piping to improve resistance to corrosion. It also pinpointed the leaks.

ONE

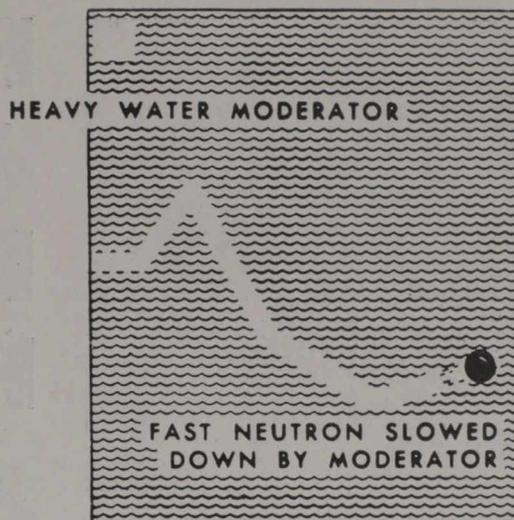


TWO



In the days before the air hold test, maintenance crews were being trained in the routine of isolating and stopping leaks operating conditions. If the section of affected pipe can't be closed off by manipulating valves, maintenance men freeze it with liquid nitrogen or dry ice. If the leaking pipe is small bore, there are special tubing pincers to squash it off and isolate the section.

THREE

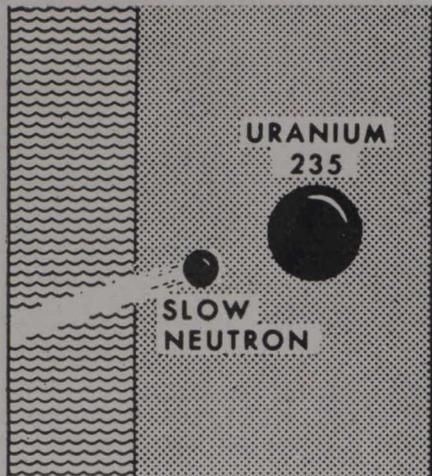


About the same time, other workers were being trained in the discipline of adding heavy water to the system. Heavy water comes in hefty steel drums. The drums are plugged into the system one by one and helium under pressure is pumped in to force the heavy water out. Each routine is the subject of a detailed written procedure.

Other work was going on to relap valve surfaces, to add spring force to keep valve packings leak-tight and to inspect and introduce improvements in pumps and other equipment. Where packing had dried out over the two years since the equipment was installed it was replaced. Valves were checked to see they operated properly and the electrically driven opening and closing mechanisms were checked so that excessive force would not be applied which could otherwise result in bending the valve yoke or stem. On completion of this work in May the heat transport system's air hold test was carried out.



ANUSHAKTI



RAJASTHAN ATOMIC POWER PROJECT

Both systems were now ready for the final helium purge, which means pumping helium in to displace air. The heavy water used for the preliminary fill was dosed with hydrazine to scavenge any residual oxygen.

Throughout the design, manufacturing, erection and commissioning of the plant constant vigilance was necessary to ensure all aspects had been controlled to achieve maximum leak-tightness. Pipe joints were welded wherever possible; many mechanical joints have double sets of gaskets with a device to collect whatever leaks through the first gasket and to return the fluid to the system. Ordinary water systems must be just as tight as heavy water systems in order to minimize the downgrading of the isotopic level of any heavy water which does escape.

Recovery routines and equipment must be set up. These include dryers to collect moisture from room air using silica-gel or molecular sieve absorbers. Drain holes in the floor collect any condensed moisture, which is led to special

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The Rajasthan Atomic Power Project consists of a two-unit station with each unit rated at 200 megawatts. It is being built on the shore of Rana Pratap Sagar near Kota, Rajasthan, by the Department of Atomic Energy. The design of the nuclear portion of the plant was supplied by Atomic Energy of Canada Limited (AECL) and the engineering of the conventional plant aspects by Montreal Engineering Company (MECO). Commissioning of the first unit was handled by a team from Ontario Hydro under a sub-contract from Atomic Energy of Canada Limited. Throughout construction there has been a small group of Canadians resident at the site and in Bombay, representing the design consultants. AECE and MECO. Representatives of manufacturers of certain equipment such as the English Electric Company (turbine generator) and Sultzer Company (heavy water upgrading plant) have been on hand. The resident engineers, technicians and inspectors of these consultants and contractors worked closely with the erection, operating and maintenance and design division of the Department of Atomic Energy.

Continued on page 11

ALL YOU NEED TO KNOW ABOUT THE CANDU NUCLEAR REACTOR

CANDU stands for CANada Deuterium Uranium. Unpacked, that means this is a Canadian-designed reactor using heavy water (deuterium oxide) as the moderator and natural uranium (oxide) as the fuel.

Deuterium is an isotope of hydrogen. Deuterium differs from hydrogen this way: the hydrogen atom consists of a proton (the nucleus) and an electron whizzing round it. The deuterium atom has a nucleus consisting of a proton and a neutron. Chemically, it behaves much like hydrogen. Hydrogen combines with oxygen to form water (H_2O). Deuterium combines with oxygen to form heavy water (D_2O). It's heavy because of the extra neutron in the deuterium atom.

What's heavy water like?

Much like ordinary tapwater, but it costs more than Scotch.

Why so expensive?

Because it's hard to get and there's a big demand for it. Heavy water occurs naturally in ordinary water. But on an average there's only one molecule of heavy water among 7,000 molecules of H_2O .

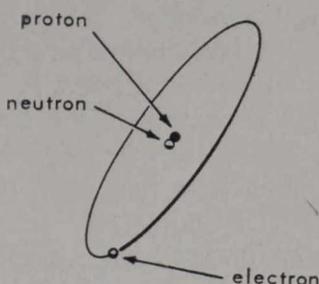
How do you get at it?

Theoretically you ought to be able to boil off the H_2O . Heavy water boils a degree or so hotter than H_2O (it freezes at 40 degrees Fahrenheit). But the

process used industrially is much more complex. Canada has several heavy water plants and India is planning four. One will be at the RAPP site.

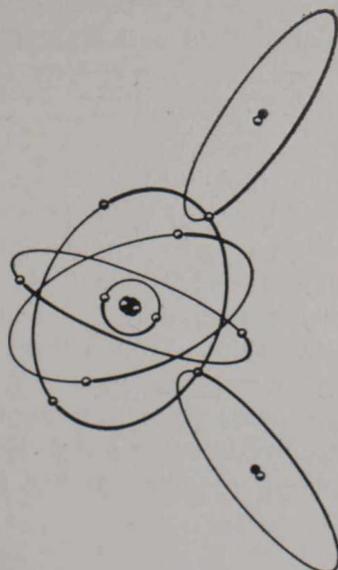
What's a moderator?

It's anything that slows down or moderates the fast neutrons given off by nuclear fission.



And fission?

Fission is the splitting of an atom of a radioactive material, in the present case uranium-235. As the atoms of uranium break up they emit neutrons which normally would fly off into space. The moderator intercepts them.



What for?

The object of a nuclear power plant is to exploit the heat which is a by-product of fission. But under natural conditions uranium disintegrates too slowly to provide a source of heat of any consequence. To get significant amounts of heat, we step up the rate of fission. This is done by bombarding the uranium with neutrons. The impact triggers further fission.

How do we do that?

That's the function of the moderator. In a CANDU nuclear reactor, neutrons flying off uranium fuel bundles encounter the neutrons of the deuterium atoms in heavy water. Like repels like, so the marauding neutrons carom off the deuterium atoms, in the process getting slowed down. All this goes on inside a vessel holding hundreds of fuel bundles side by side with heavy water in between. Chances are a ricocheting neutron will bump into a neighbouring fuel bundle and set off more fission. That liberates more neutrons, which go careering out into the heavy water and suffer the same fate. Pretty soon you have a chain reaction. The breakdown of uranium, normally a process lasting aeons, is accelerated astronomically. As this happens, heat is also released from the fuel bundles and—presto!—you have a nuclear power source.

The core of a CANDU reactor is a vessel called a calan-

dria. It's a large flattish cylinder stood on its side—not the way you see it on the truck (p.14): that's just to transport it. In a CANDU nuclear reactor, the calandria is full of tubes which hold the fuel bundles. There are 306 horizontal fuel channels in RAPP I, each containing 12 fuel bundles. The whole thing is sealed up at both ends. To produce a chain reaction, you then flood the calandria with heavy water. As the level of the heavy water climbs, more and more fuel channels are immersed—just as many as the operating crew wants.

How hot does it get inside a fuel channel ?

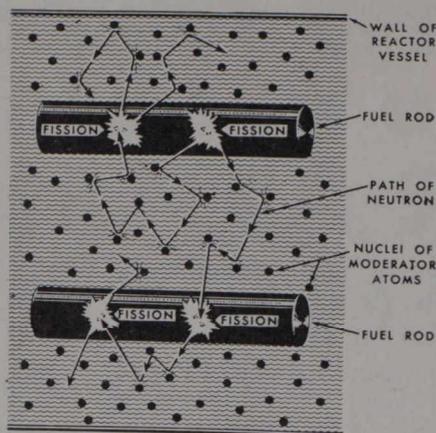
Maximum 3,500 degrees Fahrenheit (1,930 degrees Centigrade).

Why doesn't the whole thing just melt ?

Because the heat is carried off as fast as it's produced. It's one thing to produce a controlled nuclear reaction. It's another to harness the heat, in this case to make steam to turn a turbine-generator. To take off the heat there is a separate system known as the heat transport system which in turn produces steam to drive the turbine-generator direct.

So there are two different lots of heavy water ?

Correct. One, the moderator, is stored in the dump tank under the calandria and pumped up into the calandria as needed. The other, called the coolant, is



forced through the zircaloy tubes past the fuel bundles and round to the exchange boilers to heat ordinary water for the turbine generator. When it leaves the fuel channel the coolant is at 560 degrees F. By the time it completes the circuit it has cooled to 480 degrees F. That much heat has been passed on. Of course, the coolant operates under high pressure (1,500 pounds per square inch at the entry to the fuel channel).

Fresh uranium fuel is harmless, but spent fuel is highly radioactive. Hence refuelling is done by sophisticated machines behind steel and concrete doors. Personnel who enter the reactor building wear special clothes and carry radiation badges. There are strict decontamination drills.

Spent fuel is buried for years under 20 feet of water in a concrete-lined pit. Then there's tritium—a radioactive toxic gas readily absorbed by the lungs and the skin. Tritium is hydrogen's other isotope. When heavy water passes through a functioning reactor some of the deuterium atoms capture neu-

trons released by the fission process.

Tritium gets out when there's a leak in one of the heavy water systems. To localize the threat it poses, areas prone to contamination are kept at lower atmospheric pressure than the rest of the plant. Otherwise a draft might sweep the tritium into the other buildings.

There are other safety devices. The calandria can be emptied of heavy water in seconds. Normally the head of heavy water is stabilized with helium. The moderator circulates to carry off waste heat from the calandria. If the control room wants to it can stop the reaction by rapidly emptying all the heavy water from the calandria.

The worst thing that could happen would be a major rupture of the heat transport system. This could fill the reactor building with heavy water vapour at high pressure. In case that ever happens, there is a dousing tank in the dome of the reactor building which can deluge the interior with water to condense the steam and prevent the pressure building up.

The plant contains sophisticated safety devices. Before the operator can throw the switch unleashing the fission process he must unlock the equipment with keys taken from the doors of the reactor building. If the keys aren't in place it may mean someone is inside the building, or didn't close the door when he left. ■

HOW RAPP WAS COMMISSIONED

IT WAS a race against time, a successful struggle to assimilate the new technology. Hundreds of engineers, tradesmen and labourers striving towards a date the date RAPP went critical.

Continued from page 8

sumps. Special clothing with breathing air supplies which look like astronauts' space suits (and even the old mop and pail) are strategically located. Care and speed are important to contain and collect any leaking heavy water.

Since tritium is radioactive it is possible to detect its presence with ion chambers. By monitoring the areas that might harbour tritium, technicians can gauge not only what the radiation hazard is but also how much heavy water has leaked out. This supplements other leak detection techniques such as probes located under all critical pieces of equipment. Recovered water is fed into the upgrading tower, the tallest building in the RAPP complex. There it is returned to the specified purity by a distillation process which separates light from heavy water.

The moderator system was ready for its preliminary heavy water fill in June. Ten tons of D_2O (the "D" stands for deuterium) were added and circulated to flush out any ordinary water that remained in traps in the piping. Afterwards it was pumped to the upgrader to be purged of the H_2O it might have picked up en route.

While the air hold test was underway work continued on the core of the reactor. Technicians had lowered a tube into the hatch on top of the calandria and installed three temporary ion chambers. These sensitive instruments would register the first generated fission from right in among the fuel channels when the reactor went critical. Later the tube and cham-

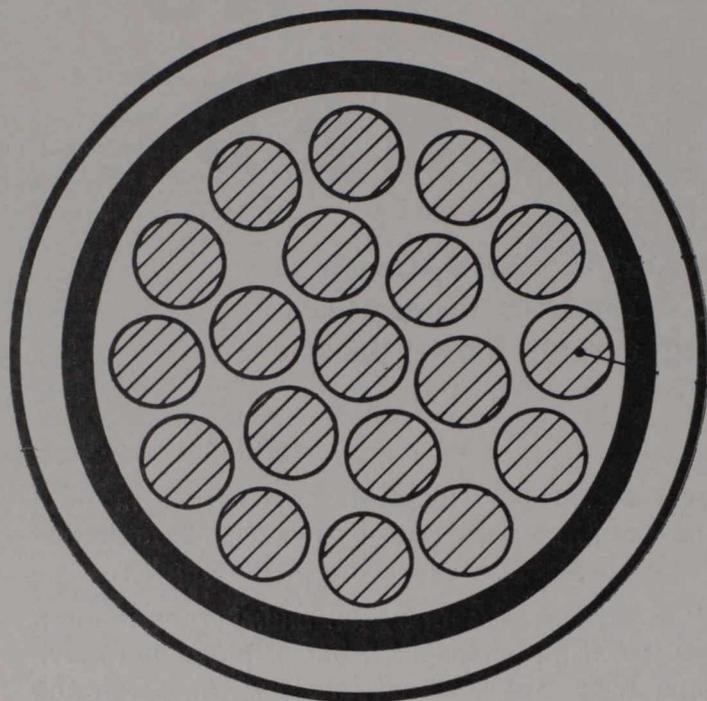
bers would be withdrawn and fission monitoring would be performed by ion chambers permanently installed to one side in the reactor.

To test the temporary ion chambers, a neutron source in the shape of a bar of plutonium beryllium alloy was lowered into the tube with the ion chambers to check their sensitivity and the link-up with the plant's control room.

The source test, as it is called, was a delicate part of a bigger operation: checking out the electronics of the control room. One of the humbler tasks involved plant electricians checking the thousands of wires behind the control equipment. Alarms and controls were now being set. Linked to the plant's various systems through a network of back-up equipment, the control panel keeps tabs on a multitude of parameters. It is topped by a battery of alarm lights related to things like the rate of increase of nuclear fission.

Near the end of June the heat transport system was finally cleared to be filled with heavy water. The storage tank, the main piping and heat exchanger-boilers on each side of the reactor were filled to the minimum working level. Meantime, technicians were replacing metal samples called corrosion coupons, which are installed to monitor the behaviour of various materials used in the heat transport system during commissioning and operation. To counteract any oxygen a measured quantity of hydrogen was pumped into the system. Dissociated hydrogen, deuterium and oxygen were passed through catalysts, in effect burning

Continued on page 12 Column two



Cross-section of a fuel channel. The outer circle represents the zircaloy calandria tube immersed in the heavy water moderator. Inside is a zirconium alloy pressure tube. The gap between these two tubes serves to minimize the escape of heat. Inside the zircaloy pressure tube are the fuel bundles, each of which is made up of 19 smaller tubes containing uranium oxide pellets. The pellets measure approximately 2 by 1.5 cms. Total weight of fuel in the reactor is 41,600 kilograms. A fuel bundle lasts about two-and-a-quarter years. Spent fuel is replaced remotely to minimize radioactive contamination. Fuel channels are open at both ends for refuelling. The spent fuel is pushed out of one end and fresh fuel is inserted in the other end.

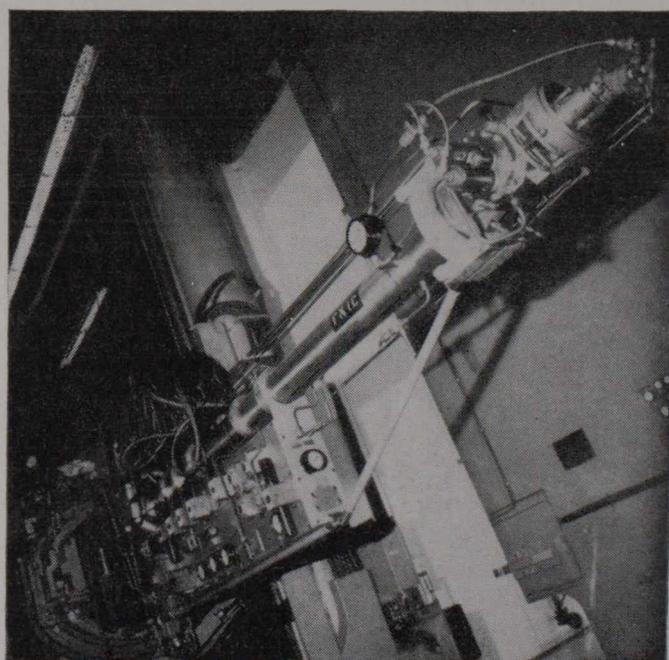
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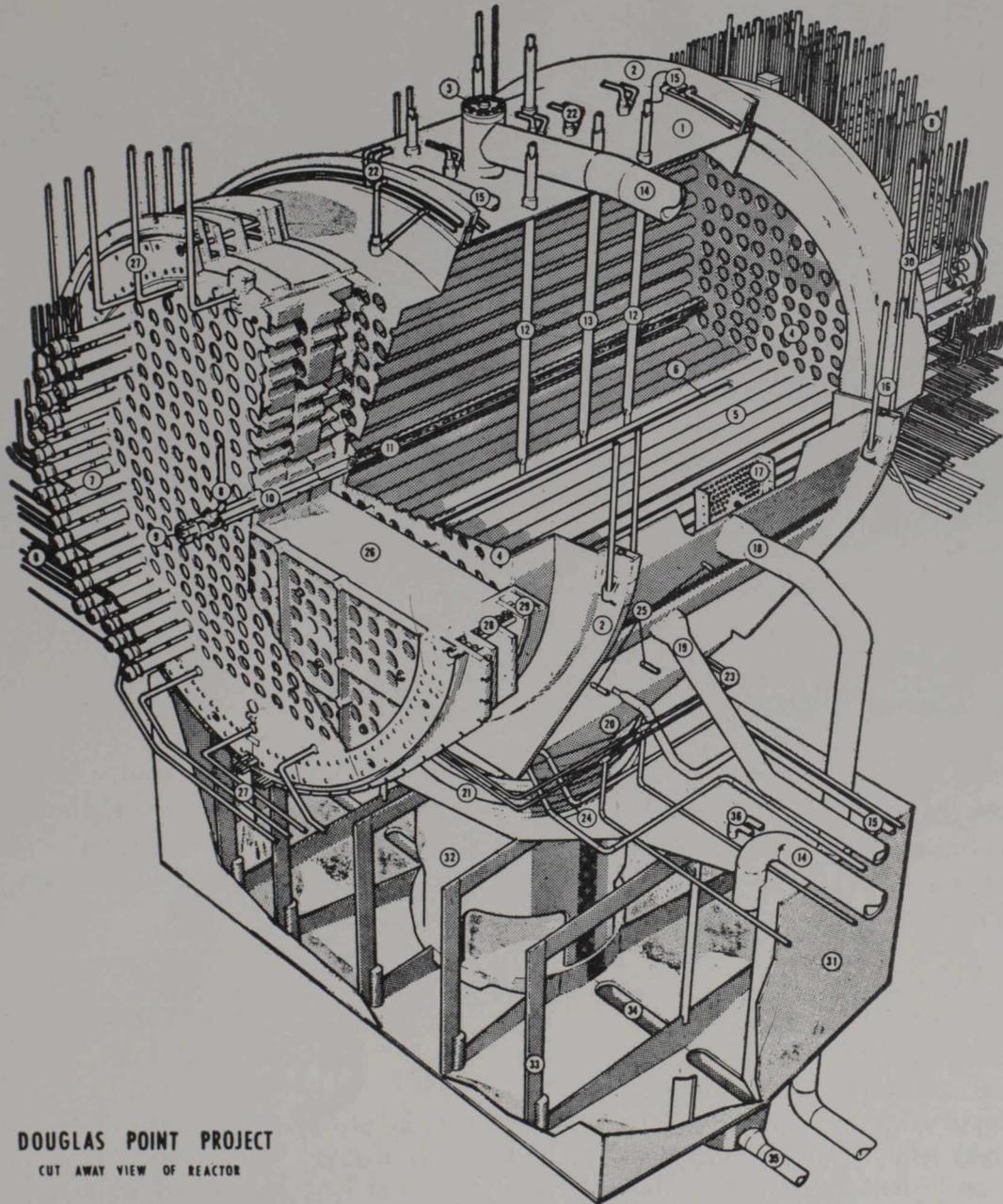
the hydrogen and scavenging oxygen. The pumps were started up to circulate the heavy water. Technicians had by now launched into the routine of continuous data taking which would go on as long as RAPP I was in business

In the heat transport system they were working up to the next stage of the commissioning drill. That would involve stepping up the circulation of the heavy water, which would heat up by pump heat alone to about 400 degrees Fahrenheit. It takes about 12 megawatts to run RAPP I. Most of this energy is needed to run pumps. Besides the State grid, there are three alternative sources of power: batteries, diesel generators and the power produced by the station's own turbines. A power breakdown could immobilize some of the plant's pumps. In order to maintain essential cooling on fuel and other items, the plant has several ranks of standby power. After checking terminals and tripping devices the plant's electrical staff stood by to switch off power from the State grid during the heat transport system warm-up. Instantly the batteries took over in the moments that elapsed before the standby diesel generators started up.

Continued on page 14

Perspective view of a refuelling machine

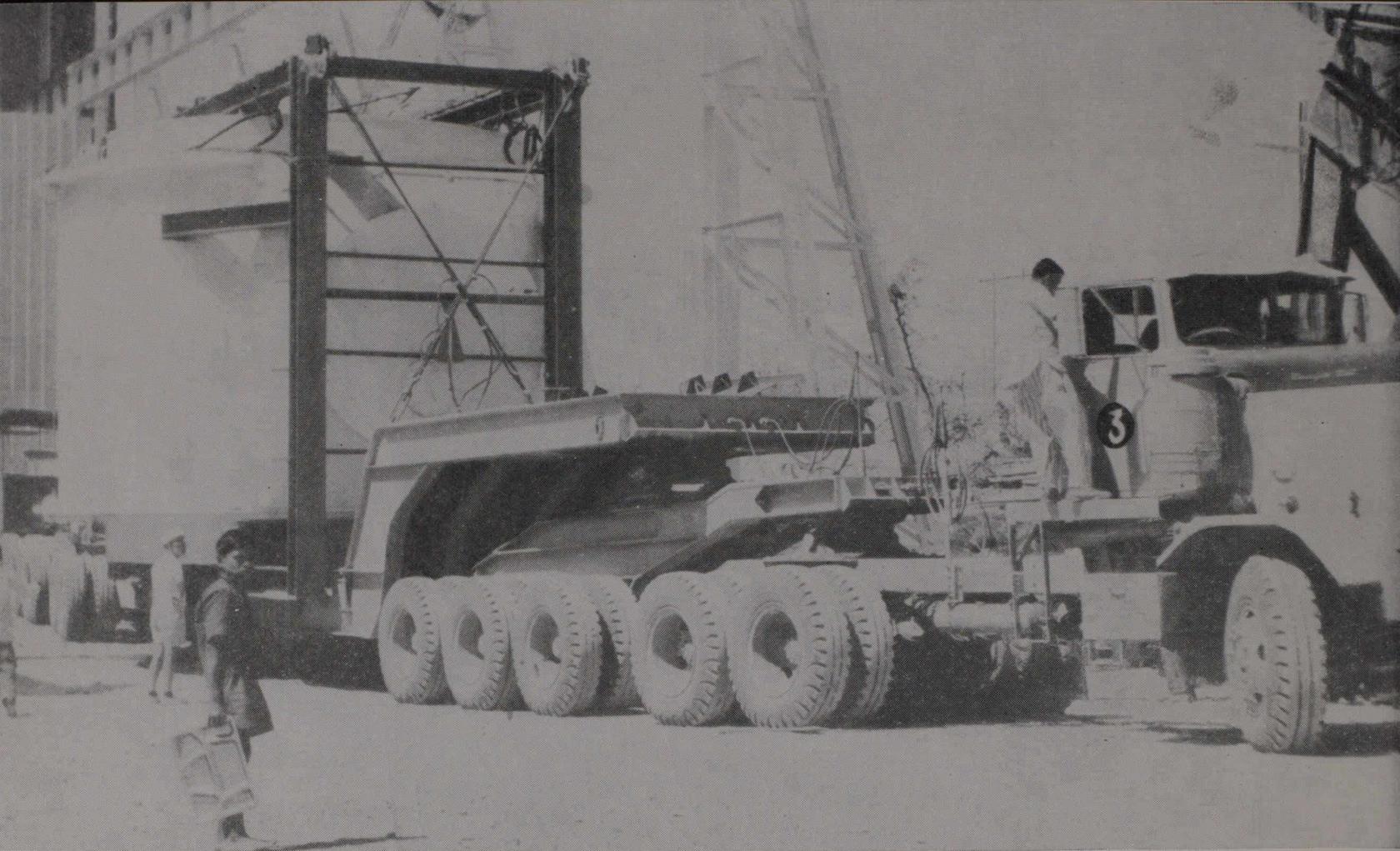




DOUGLAS POINT PROJECT
CUT AWAY VIEW OF REACTOR

- | | | | |
|--------------------|-----------------------|-----------------------------|--|
| 1 CALANDRIA SHELL | 11 FUEL | 21 EXPANSION JOINT | 30 END SHIELD HANGERS |
| 2 STIFFENER RING | 12 BOOSTER RODS | 22 CALANDRIA SPRAY COOLING | 31 DUMP TANK |
| 3 INSPECTION HATCH | 13 ABSORBER RODS | 23 DUMP BOX SPRAY COOLING | 32 SHIELDING & STIFFENER STRUCTURE |
| 4 TUBE SHEET | 14 HELIUM LINE | 24 TRANSITION SECTION | 33 STIFFENERS |
| 5 CALANDRIA TUBES | 15 HELIUM PURGE LINE | 25 LEVEL INDICATING INLETS | 34 DRAIN SLOTS |
| 6 COOLANT TUBES | 16 CALANDRIA HANGERS | 26 END SHIELD | 35 DUMP TANK OUTLET |
| 7 END FITTINGS | 17 MODERATOR MANIFOLD | 27 END SHIELD COOLING PIPES | 36 DUMP TANK & EXPANSION JOINT SPRAY COOLING |
| 8 FEEDER PIPES | 18 MODERATOR OUTLET | 28 END SHIELD RING | |
| 9 SEALING PLUG | 19 MODERATOR INLET | 29 THERMAL SHIELD BLOCK | |
| 10 SHIELDING PLUG | 20 TRANSITION SECTION | | |

A cutaway view of the Douglas Point reactor core.



The calandria for RAPP I, made in Canada, was overlanded from Kandla port on the west coast to the Rana Pratap Sagar site. It needed a special Canadian truck to deliver the 70-ton core of the reactor. Roads

and bridges on the route were specially reinforced and widened. Canada's National Film Board made a film about the journey and called it, aptly enough, "Juggernaut".

Continued from page 12

Concurrently with the commissioning of the moderator and heat transport systems work had been going on in half-a-dozen other departments, from the turbines to protective systems. All had to be ready for the big day when the reactor went critical. That day, the neutrons flying off the natural uranium packed in the fuel bundles would encounter heavy water as the level rose in the calandria. The neutrons would be slowed in their hectic course and would find their way into adjacent fuel bundles, setting off a chain reaction.

At first only a small number of calandria tubes would be immersed, enough to yield only about

a millionth of full power. The commissioning team would enter Phase B of their activities. Phase B was concerned with reactor physics measurements. Technicians would check the effect of different heavy water levels on the output of the nuclear power and the impact of absorber rods on the reaction. For about two weeks plant scientists would take their final physics measurements and then power would be stepped up to 2 per cent, then 5 per cent, enough to raise steam for the turbines and make the station independent of the State grid for its own power needs. Thereafter power would be gradually increased to synchronize RAPP to the grid and power would be sent out into Rajasthan. ■

MEDICARE

TEN YEARS AFTER

A doctor told a friend in all seriousness: 'I foresee the day when there will be barbed wire on the borders of Saskatchewan and jack-boots tramping the streets.

By JOAN HOLLOBON

IN July 1, 1962, Canada's first government medicare plan was introduced by Saskatchewan's socialistic Government. The medical profession saw it as the first step to tyranny: authoritarian control of doctors, soon to be followed by subjugation of all the professions and indeed of the public at large.

Political passions rose to a point that seemed grotesque, a fantasy, in calm Canada.

Where passion marked the past, pragmatism rules the present: cool, realistic pragmatism to a point where the Saskatchewan Medical Association has calmly suggested a Rand formula checkoff of association dues by the Government on behalf of the SMA from a doctor's medicare claims. The concept of compulsion on all doctors to pay dues is as incredible as the use of this distinctively labor union term, when viewed against attitudes and events of 10 years ago.

In July, 1962 doctors withdrew all services for 24 days, except for emergency care at 29 of the province's 121 hospitals. They were staffed by less than a third of the profession,

who worked for nothing because they refused to work under the medicare act.

Doctors closed their offices, refused to visit patients at home or in other than the designated hospitals. Many took vacations or left the province. Tension rose to match the sweltering weather. Ill feeling, suspicion, wild statements, even threats of physical violence, followed one another on a rising scale.

The profession and the Government no longer talked to one another directly, so that communication more and more was conducted through press statements designed by both sides to recruit public support, which increased polarization of positions and further inflamed resentment and suspicion.

Citizens' groups sprang up overnight. They included Keep our Doctors, supporting the profession, and Community Health Clinic Associations, supporting the Government. They were more intemperate than the main antagonists, deliberately seeking to whip up emotions.

Today, medicare is part of the scenery, working well and efficiently, on the whole. The Government and the medical

profession are not always happy with one another—the doctors still fear Government intentions—but both sides discuss problems rationally behind closed doors, not in screaming headlines.

Changes that seemed so revolutionary 10 years ago have come to all of Canada. Saskatchewan was the pioneer: medicare swept across the country with provisions in some provinces more restrictive on the profession than in the province where its introduction was seen as the first step on the road to dictatorship.

A decade inevitably brings changes in views and attitudes and nowhere is this more apparent than within the Canadian medical profession. Ten years ago the profession saw itself as a group apart, doing a sincere, competent job that earned it the right to be left alone.

That is not true today. The profession has gone through much soul-searching. Doctors still believe deeply that for the public's good, as well as their own, the profession must be free to control medical practice without bureaucratic interference. But now they are separating

more realistically what is essential to that freedom from the mere accretion of custom; undertaking more effectively the responsibilities imposed by it; and accepting a role in society carrying corporate, as well as individual, social obligations.

The profession no longer sees all the proposed organizational changes in health care as inevitable threats to its freedom or quality of medical care, although it fears some might be, as indeed they could. The profession is willing, even eager, to participate in the process of change as it was not a decade ago, and to do it in co-operation with others, including governments and laymen. From isolation and superiority, the medical profession is moving toward equality and social involvement in a new way.

Saskatchewan has been influenced by this changing climate in the rest of Canada, but has also contributed substantially to it. The Saskatchewan crisis of 1962 opened the era of government intervention in personal medical care and the profession's re-evaluation of its own position, even though both took several more years to develop.

The Saskatchewan doctor's strike left deep scars on the medical psyche everywhere, as well as creating rifts and bitterness within the profession that still have not entirely disappeared. Doctors resent the word strike: they say they set up an emergency service during the 23 days in July, 1962, and, in any case, were not employees and therefore could not strike.

Nevertheless, the doctors' "withdrawal of services" was

seen as a strike, a labor-management connotation that created further resentment by its implication that doctors were seen as employees.

That doctors would actually refuse to treat patients in any circumstances shocked everyone, including the doctors, but it denoted the depth of their feelings. Few even today regret the action: they feel they fought for an important principle, that their stand drew national attention to the dangers of Government controls that influenced later events even though medicare was introduced throughout Canada.

Dr. H. D. Dalgleish, president of the College of Physicians and Surgeons of Saskatchewan in 1962 and today its registrar, said: "We thought it was the right thing then. I would certainly act the same way, given the same situation, but you can't transport the past to the present."

It was no accident that medicare came first to Saskatchewan, which had a long history of co-operative action born of adversity. With a one-crop rural economy dependent on the vagaries of harsh climate and fluctuating markets. Saskatchewan people had often survived hardship only by community action, often through local councils backed by Government. These characteristics of self-reliance combined with communal co-operation flowered during the Depression, which hit Saskatchewan savagely.

Saskatchewan doctors suffered the economic squeeze at least as much as the patients on whom they depended for a living. From early in the cen-

tury they led in community action to combat illness, first against tuberculosis, the major scourge of that era, and later against cancer. In 1929 the doctors proposed and worked with Government to establish a publicly financed cancer program that has been a model for Canada. In 1919 the Government authorized municipalities to use taxes to pay retainers to keep doctors in communities.

As early as 1916 the first legislation was passed allowing local tax levy for hospitals and by 1927 the legislation was amended to permit municipalities to pay hospital costs from general tax revenue.

In 1947 hospital insurance was brought in for all Saskatchewan residents, 12 years before Ontario acted.

In 1942 the Saskatchewan College of Physicians and Surgeons wrote to the Government, saying it favoured "state-aided health insurance on a reasonable fee-for-service-rendered basis."

With this background, why, 20 years later, was there an outcry and, of all things, a doctors' strike, against medicare?

In 1942, the voluntary, non-profit, prepaid medical insurance plans were only four years old. By 1962 they covered nearly 70 per cent of the population, so the profession felt a blanket government scheme was no longer necessary when two-thirds of the people were insured. The Government looked at it from the opposite direction, saying that with a third of the population not covered a broader scheme was needed.

More important, the college's 1942 proposal had included the

proviso that administration of state-aided health insurance should "be put into the hands of a non-political independent commission on which the medical profession is adequately represented by its own representatives elected by and responsible only to the College of Physicians and Surgeons of Saskatchewan."

This is a far cry from a commission directly responsible to government and only government. The doctors also said they had not been consulted and that the proposed act contained two clauses capable of providing absolute control over them and their patients.

Influences in the background were the changed economic and political climate of 1962. The Depression had passed, the war was over, the province's economic situation had improved, the Cooperative Commonwealth Federation Government had been in power for 18 years and many of its good measures had become part of the scenery while some of its more irritating and restrictive measures were chafing people ripe for political change.

Doctors had accepted salaries or subsidies to work in small communities otherwise incapable of supporting them, but their contracts had been with local governments. This kind of ad hoc local situation was different from the entire profession in the province agreeing to work under a centrally administered plan, especially one seen to hold the potential for putting all doctors on salary and dictating their terms of work.

Dr. Dalgleish, who led the profession through the crisis, told

the CCF's annual convention then that the doctors had first seen the draft legislation in October, 1961, and considered it "not a device to provide medical services insurance, but a measure which should be used to control medical doctors and their patients."

The first provision of the Medical Care Insurance Act to which the profession objected empowered the Commission to prescribe "the terms and conditions on which physicians and other persons may provide insured services to beneficiaries." The second declared the commission the agent of the insured person for all purposes, able on his behalf to enter into agreements, take court action and pay the doctor.

The Government offered to change the legislation by regulation passed by order-in-council permitting doctors to be paid by the patient, who would then claim reimbursement from the medical plan.

The profession rejected this, because it said an act cannot be changed contrary to its intent by regulation, only by new legislation, otherwise it could be changed back again by new regulations at government whim. The doctors also claimed that the reimbursement mechanism did not really allow them to practice outside the act, because they would still have to supply information to enable the patient to claim from the plan. They would therefore still be providing an insured service and would continue to come under present and future regulations of the Act governing the practice of medicine in Saskatchewan.

Later, E. A. Tollefson, who was then assistant professor of law at the University of Saskatchewan, wrote in the Saskatchewan Bar Review that the dispute arose largely through failure of both sides "to understand the intricacies of our legal system."

He said the Government proceeded without consulting the legal counsel of the college "with a view to embodying in the act, clearly and decisively, protections for the independence and the integrity of the medical profession." The doctors, on the other hand, "have not only given the act the most perverse interpretation conceivable, but have failed to appreciate the constitutional rights and obligations of a minority group in a democratic society. The failure to give the act a reasonable interpretation and to distinguish possibility from practical probability in its operation is a failure to understand how our courts operate in constructing the law."

At the time without the benefit of hindsight or time for considered analysis, the interpretations precipitated a struggle finally resolved when Lord Taylor was brought in as a consultant and remained to mediate the crisis, which ended with the Saskatoon Agreement of July 23, 1962.

A British doctor and formerly a Labor member of Parliament, Lord Taylor is now president of Memorial University of Newfoundland. A huge, rumpled man, shrewd and imperturbable, he brought a note of sanity to the tense situation, wandering back and forth chewing on his pipe from the college to the Cabinet.

Both sides made some concessions in the Saskatoon Agreement. The Government agreed that the doctors could seek care privately and pay a doctor directly if they wished; that the non-profit prepaid medical care schemes could continue to work in partnership with medicare; and that the commission would report to the Legislature.

The doctors for their part recognized they could not compel the Government to change legislation by strike action; they accepted the principle that doctors could work on salary from the commission if they wished; and, most important of all, they recognized the Government's medicare plan.

How does it stand now, 10 years later?

Doctors retain the freedom to bill for medical services in several ways: through medicare, through the non-profit plans, to the patient who can be reimbursed by medicare or by private agreement with a patient. This is a freedom no longer available to Ontario doctors, who last November had to choose either to bill medicare or bill their patients. Saskatchewan doctors can use all four methods in their practice if they wish; Ontario doctors must choose one method or the other for all patients.

In practice, the majority of doctors bill medicare. The two approved health agencies, Medical Services Inc. and Group Medical Services, still exist, but have become more post offices, which reroute claims to medicare. As every year passes, fewer patients and doctors use them and both schemes have

switched most of their activity into covering extra benefits, such as ambulance service, private nurses, drugs and others, much as Blue Cross has done in Ontario.

Not all, however, is sweetness and light.

Some of the fears the profession entertained in 1962 remain and have been reinforced by the re-election of the New Democratic Party last year and also, curiously, by trends increasing throughout Canada for new forms of health services.

One, which ties in closely with the political creed of the Saskatchewan Government and its labour supporters, is for walk-in community health centres providing integrated health and social services, which is proposed as a means of reducing admission to hospital, a move aimed at cutting costs.

Walter Smishek, 47, the present Health Minister, opposed running medicare through a commission, rather than integrating it directly into the Health Department; opposed fee-for-service payment of doctors, preferring salary; opposed deterrent fees; and disliked premiums for medical insurance, preferring income tax.

Deterrent fees have already been removed for all as have premiums for those over 65. Premiums produce only a small proportion of medicare revenue (about \$5.7-million against a total cost of more than \$37.5-million). Premiums are the same now as when they were first set in 1962: \$12 for a single person and \$24 for a family a year (hospital insurance costs an additional \$24 and \$48 respectively).

While criticizing fee-for-service as a piecemeal system that "thrives on quantity and undermines quality of care," creates cumbersome administration and promotes wasteful competition, Mr. Smishek says he recognizes circumstances may compel its retention in some form.

But it is the Government's plans for community health centres integrating health and social services that cause the most uneasiness among many doctors. They are feared as the first step toward a system that could sound the death knell of independent, fee-for-service medical practice and traditional control of health services by doctors.

Integration of health and social services cannot avoid eroding the process where he becomes one professional among equals. Consumer participation could become consumer control, where all professionals are directed by lay boards: there are groups in Saskatchewan pressing for exactly that. The more pessimistic fear that from there it is a short step to direct operation by Government fiat.

In an interview, Mr. Smishek said community health centres "will not be forced down people's throats." He said regional health planning councils should include consumers, as well as providers; should plan health care within the whole context of social services and education; should be based on an "economically viable" region, although it should not be too large; and should produce a flexible system to cope with population changes.

But, he said, the Government will be cautious so that people

do not misinterpret plans and fear abolition of the present municipal structure, which is not intended. (This has been of great concern to many rural communities).

The conciliatory tones have not allayed the fears of all doctors, who recognize that evolving social patterns can exert coercion in the long run more effectively than revolutionary changes that provoke resistance. Few oppose the idea of using in a new way rural hospitals too small to provide effective conventional hospital care. The real concern centres on four urban facilities much closer to the minister's hand for health care experiments: the three remaining community health clinics at Regina Saskatoon and Prince Albert and the Grey Nuns Hospital.

Last March, the Government began to finance the community clinics in a new way, bypassing the fee-for-service system, allowing them to broaden their health and social services.

Community Health Clinics were created during the 1962 crisis by pro-Government citizens' groups and a few Saskatchewan doctors dedicated to the concept, such as Dr. Sam Orville K. Hjertaas of Prince Albert. They were staffed mainly by doctors brought in from Britain on short-term contract to serve during the crisis. Some settled in Canada, such as Dr. David A. Road and Dr. Peter Beaglehole of the Regina clinic.

The clinics and their doctors were the focus of the greatest resentment in 1962 because they supported the Government, directly opposed the profes-

sion's stand, accepted salaries and worked with lay groups in running the centres.

This bitterness took years to diminish and has not totally disappeared, but few practical problems arise now.

From the beginning the clinics espoused the use of non-medical staff, such as social workers, to provide preventive and treatment services, but medicare, designed only to pay doctors, made no provision for such people. Clinics which used them paid them from the doctors' fees, which are pooled and paid out to doctors in salary, much as in conventional medical group practice.

The clinics ran into financial trouble with this arrangement and appealed to the Government to pay them a global budget as they do to hospitals: a total sum to be allocated more broadly. Global budgeting for the three clinics began last March.

Cost control is exercised through routine scrutiny of medical claims by the commission, confirmed by regular, routine random checks of patients through letters seeking verification of services reported. Detailed profiles are compiled on every doctor's practice which permit comparison of his pattern of practice with the average for doctors in similar types of practice. If a profile shows marked deviation information is sent to the Saskatchewan Medical Association which refers it for detailed scrutiny to the professional review committee.

For years the review committee was poorly backed up by the college, which formerly had the job done now by the

SMA, because the college saw discipline in terms of suspending a doctor from practice for negligence and was uneasy about applying economic sanctions. The Government says it is better satisfied with the profession's approach during the past year.

Surveillance is still resented in some quarters, but Dr. R. G. Murray, chairman of the commission, said, "If doctors believe in the fee-for-service system they should not exploit it."

Profiles on medical practice have a potential far greater than simply cost control. Medicine is not an exact science: doctors can honestly differ in how many X-rays or tests they order or how often they see a patient.

Prior to detailed, computerized information from medicare there was no way valid comparisons could be made across the whole medical profession. The potential for raising medical standards through such studies was outlined last March in the Canadian Medical Association Journal by two officials of the Department of National Health and Welfare. Publication in the Journal itself was an interesting commentary on the greater acceptance accorded such far-reaching concepts.

The Saskatchewan Government's introduction of medicare in July, 1962, swept away the status quo forever; never again can the profession be uninvolved in social planning in its broadcast sense. To that extent the profession lost, but loss of a narrow freedom can be the gain of a greater and more influential position if the public, as well as the profession, remembers the issues and the results.

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Some of the 15 Bangladesh orphans who were flown to Canada last month for adoption under a Families for Children program. High Commissioner James George and Carol George made friends with the babies in the Delhi airport transit lounge.

