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FEATURES

DEPARTMENTS

LOOKING BACK

This Space

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"THIS Space" in *Electronics & Communications* is reserved for your editor. In it he will generalize on topics of interest both relevant to the industry and otherwise. We think this is a good idea because our office, like many other editorial offices, is a cross-road for many people. It is a place of free and easy discussion where opinions and ideas are stripped of their extraneous wrappings by the process of friendly discourse and left standing for what they are worth in the stark rawness of their fundamentals. Oft-times there is good reason to ponder what remains of some of the thoughts which are expounded in our office.

People are inclined to talk freely in an editorial office because primarily it is a place for the dissemination of ideas and those who come to us, we believe, feel protected from the searching and practical eyes of professionally trained people who, unfortunately, due to the pressure of their present day obligations have little time to listen to suggestions which appear to be outside the accepted principles of their profession. Yes, people while in our presence always seem ready to reveal their ideas to us knowing that they will be listened to with the interest of curiosity at least.

Those who do come to us seeking information or advice often leave us richer in knowledge as a result of their visits. When people can't come to us they frequently send us letters and one way or another our office is a clearing house for much information which we think is worth passing comment on and the topics to be dealt with in "This Space" will be based largely on the interesting items that we are privileged to hear from time to time.

Hackneyed But Still True

The expression is a bit hackneyed but nevertheless still true that many of the greatest inventions which have become a boon to mankind were conceived in the minds of persons who, from a professional standpoint, just didn't know what it was all about. The fact that such people were not professionally trained was unimpor-

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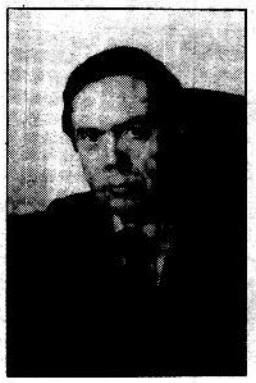

March 4, 1983

Please accept my warmest congratulations on the thirtieth anniversary of Electronics & Communications.

Your publication, Canada's oldest in the field of electronics, has not only witnessed an unprecedented revolution in the development and application of technology, but indeed has been a part of it.

When the first issue of Electronics & Communications was published in the spring of 1953, science in Canada was in its infancy. The National Research Council led the way in pure research, but research then had little orientation towards business. In fact, the post-World War II period was generally characterized by a lack of direction for science in industry. Research was conducted in an academic environment with little liaison with the business world.

Times have changed. The Glassco Commission Report in the late 1950s criticized Canadian policy makers for the absence of a science policy direction. The Lamontagne Commission Report in the late 1960s recommended that the emphasis for R&D should be with industry.

Anniversaries are an occasion for looking back at the past to better appreciate the present. Twenty years ago, in 1963/64, total federal expenditures in the natural sciences were $306.1 million. Today, in 1983/84, that budget is expected to reach over $2.5 billion. In 1963/64, direct federal support to R&D performed by industry was estimated at about $47.0 million. This fiscal year, it is estimated that industry will receive about $461.5 million.

Canada has made many advances into the frontiers of science and technology over the last thirty years. The launching of the Alouette I satellite in 1962 marked the beginning of Canada's Space Program and made this country a world leader in telecommunications technology. More recently, we witnessed the success of the Canadarm on the space shuttle Columbia. This marks an auspicious step forward for Canada in robotics technologies.

Telidon is another such success story. Last June, Telidon was adopted as the single videotext standard in North America by the Canadian Standards Association and the American National Standards Institute. Telidon is an example of the potential we can achieve through the active cooperation of industry and government.

This issue marks the thirtieth anniversary of Electronics & Communications. It is also an occasion for reflecting on the growth of the science and technology-oriented industries in Canada, and for congratulating Electronics & Communications for reporting their progress so successfully.

Yours sincerely,

Donald J. Johnston

Canada

tant. What was important was the fact they had ideas and the courage to pursue them in spite of their conflict-tion with the generally accepted beliefs of what could, and what could not, be done. We meet many such people and we're pleased to listen to them because as far as invention is concerned conditions today haven't changed much and we'd be willing to bet that many a significant development is still destined to be worked out in some attic room or basement workshop by people who just do not rank professionally.

Only 25 years ago the thought of travelling to the moon was looked upon as absurd, a fantastic idea used by fiction writers as the theme for many a hair-raising tale. Today responsible members among Britain's leading scientists claim that in the next 25 years man will have conquered space and landed on the moon.

As we said, we hear tales in our office, some fantastic, some not so fantastic, but who today is bold enough to prophetically declare that the fantasies of today will not be the realities of tomorrow?

Now with the comparatively new science of electronics the horizons for future developments appear to be limitless. Its application throughout the broad fields of industry, business and science would, in view of the progress that has been made with the science in the few short years of its existence, lead us to believe that the future will reveal to us, and provide for us, wonders far beyond the wildest dreams of the most imaginative.

Sometimes We Get Ideas

Not so long ago it was our privilege to look over some electronic equipment manufactured by Electronic Associates Limited, a Toronto firm. Among their products was a device known as a Papric Dirt Counter. The instrument was developed in conjunction with the Canadian pulp and paper industry to determine the amount of pulp specks showing in a sample of paper. On the basis of such a count the quality of the paper is determined. Hitherto the process had to be carried out with the naked eye using the coordinate square method of counting the number of specks in so many areas, then taking an average of the count.

In the highly competitive business

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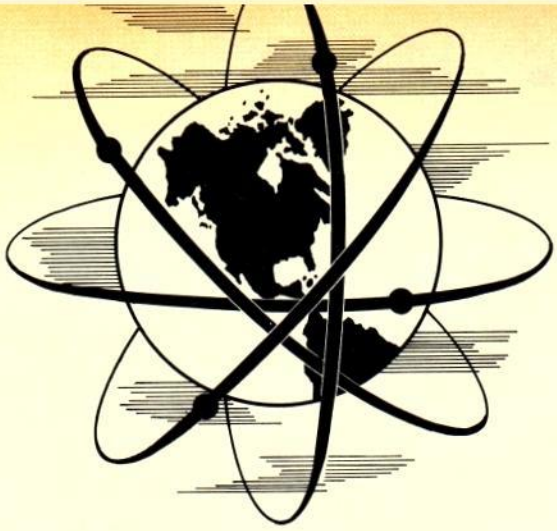
This Electronic Age



IF a definition of electronics was composed by an engineer he would probably say that it is that branch of physics which deals with the emission, behaviour and effect of electrons. But electronics is destined to affect the lives of everyone in the years ahead and it is possible to describe electronics in a more colourful manner for the benefit of those who, distinct from the electronic engineer with his technical interpretation of the subject, are interested in what electronics will mean to them in the not too distant future.

In a broader sense then, electronics is man's most versatile and useful slave. It is more than a slave. It is a genie who can move mountains, a magic carpet that can guide itself through fog or storm or darkness. A magic mirror that can show you the other side of the world.

Applied to industry electronics today, it is controlling rivers of molten metal, locating hidden treasures buried in the ground by nature thousands of years ago, and measuring the strength and thickness of materials without even touching them. Electronics can discard one bad bean from tons of beans and keep the toasted brown shade of the corn flakes you eat for breakfast consistently the same. Electronics can turn the lights of your city on as dusk approaches without the need for man to place his hand on a switch; it can bring Rawhide and the United Nations into your living room. Electronics, which has developed with fantastic speed in the past decade, is here to make life better for us and for posterity.

Since all these things are good and desirable we may sometimes wonder how long we are destined to enjoy them in a world where international relations are strained to the breaking point. Here, too, electronics can play its part, indeed is playing its part by affording us strength and assurance.

Applied to the military field electronics can make guns shoot straighter, make planes fly farther and faster. It can sense the approach of enemy planes, ships and submarines and mark their positions. It can control the gun that fires at them and guide the missile that speeds to destroy them.

Although steam and electricity are still a boon to man we have now reached the electronic age. Electronics, now passing from the laboratory stage through the engineer is spreading ever further into the proven field of practical and economical use in home and industry.

Business Revolution Due

It will not be long before even small offices can employ electronic means to keep business accounts, run continuous sales records, compute and send out bills and maintain running inventories. Nor will it be very long before those same small business enterprises can employ electronics to fix production schedules, serve as vast filing systems and chart corporate expansion. Incredible you say. Not at all.

It is natural perhaps that few laymen can see the connection between the giant electronic brains performing feats of lighning claculation on abstruse scientific problems and the coming industrial revolution in the office. It is nevertheless almost a certainty that such an eruption is about to take place because the office is ripe for revolution. The underlying reasons for such a revolution can be cited as mounting costs and the difficulty of recruiting clerical staff while the paper work increases year by year. In an effort to combat this condition thousands of offices across the country have been mechanized in recent years with the result that the business machine in industry has been almost continually booming. Up until recently however, our business machines have been purely mechanical. Now the transition to electrically operated machines is well on the way.

Many of the electrical machines which we are using in our offices today have been speeded up by electronic controls or components but none of them can hope to compare either in speed or mechanical perfection with the all-electronic machines that will soon be replacing them. It may be that the replacement of existing machines will be slow since their value represents a considerable investment, but there can be little doubt that the day is not far distant when business offices both large and small will be equipped with fully automatic business machines made possible by the science of electronics.

Communications

One of the more important growing branches of electronics is the non-broadcast radio communications service which, according to figures, is more significant than the television and broadcast station increases. Sales of safety and special radio communications units by Canadian manufacturers in 1952 totalled more than two million dollars bringing the number of land

mobile units in use in Canada to nearly 12,000.

Hand-in-hand with the sky-rocketing growth of private and public safety radio communications services comes the increasing use of microwave. Radical advances in communications show that less and less will Canadians depend on land lines in the future, particularly where new construction is involved or where difficult terrain has to be traversed. Teletype and facsimile, the science of transmitting pictures which are reproduced on radio receivers is destined to become an integral part of our police and fire departments and in telephone and other common carrier companies multi-channel microwave equipment is being employed. In this latter sphere of communications it is significant to note that it is now generally accepted that the cost of microwave in a new circuit is roughly one-half to one-third the cost of laying an equivilent land line. With microwave, maintenance costs are also low since, there are no wires or poles to blow down in storms.

Another advantage of the microwave system of communications is their extreme versatility. Single channels can carry up to 2500 messages at one time. A co-axial telephone cable can carry about 1800. There is also the advantage that messages carried on microwave systems may be either oral or merely impulses which are registered on meters or run through teletype machines.

Utilities and Railroads

In the United States microwave systems are being put to increasing use by electric power companies, railroads, pipelines, and broadcast and television stations and increasing production of these devices here in Canada now makes it possible for Canadian interests to take advantage of their use.

Information gathered from microwave systems can be passed to crews equipped with mobile units thereby effecting an efficient means of control. This system of control, first used as an emergency and safety measure by police and fire departments has now spread to many forms of business and is presently being employed with great success for more effective control of construction, forestry, logging, petroleum, taxi, street railway, power and water and gas utility companies. In many centres in Canada it is possible to obtain a mobile telephone service from the telephone company which will permit calls to and from vehicles to the trunk and toll systems. Truly then, electronics, as applied to communications has a great future especially so in a country such as Canada where long distances over rough terrain must be traversed by communications channels.

Industry Gets Boost

To industry electronics has become an important business, so much so, that many companies are now hiring electronic engineers to study ways and means of employing this new tool in their fields of endeavour.

The application of electronics to the process field of industry including rubber, chemicals, oils and plastics is almost limitless. So adaptable to control functions and measurements has electronics become that a number of Canadian firms specializing in the production of industrial electronic devices can be called upon to determine whether any particular function in your plant can be done more efficiently with the use of electronics.

Glue, for instance, which previously took hours to set, can now be set in seconds. Plastic pre-heating has reduced time and costs on the production of molded parts. Food is being processed in minutes instead of hours. Induction hardening of crank shafts, wrist pins and similar high production items for the automotive and agricultural implement trade is now commonplace. Soldering, brasing and welching operations are showing savings of labour and increased output of almost fantastic proportions. Electronic gauges and quality controls have become so reliably consistent that operators can, and do, expect miracles. Measurements without contact of strip thickness to .001 are possible at speeds of greater than one thousand feet a minute without contact.

The successful development of a tomato grading device suggests the sample grading of many other agricultural products. It is not inconceivable that eventually 100 per cent inspection of all fruit and vegetables may be carried out by electronic examination.

It can certainly be said that industry is blessed with products that need only aggressive and enthusiastic application of electronic techniques for time and labour saving devices.

Safer Transportation

Day by day the popularity of air transportation is growing and as a result it has become one of the largest users of electronic equipment. As aids to the air transportation industry there has been developed the blind landing approach instrument which at the present time is being standardized on an international basis. There is a radar distance measuring set which enables the pilot of an aircraft to measure the distance from a ground beacon to his plane. In tackling the job of making flying safer for the public it is the electronic engineers' intention to open up the dark, bad weather, ceiling zero, and fog hours to safe flying. Weather forecasting by radio meterology which is now becoming commonplace enables the expert to probe the atmosphere, seek out the turbulence that lies therein and determines its possible effect on flying conditions.

The greatest innovation in marine shipping circles since the invention of the screw propeller and the adoption of Parson's marine steam turbine is the use of radar as a means of navigation. With radar the element of guess work has been taken out of coastal navigation and ships may now enter harbour channels under weather conditions that would hitherto have deterred the most skilful of captains.

Sonar, the underwater counterpart of radar which uses sound waves instead of radio waves is an outgrowth of the older echo depth sounder and has speeded up the work of the hydrographer in charting the oceans and establishing safe routes for the ocean commerce of the world.

Canadian railroad transportation too, after a period of rigid tests, has now adopted electronics in communications services, a move that will undoubtedly add to the measure of safety in rail travel.

Such then is the impact that the science of electronics has had on industry to date.

Its horizons for tomorrow are unlimited.

E&C EDITORIAL

Dedicated To The Industry . . . .

The 41st annual convention of the Institute of Radio Engineers held recently in New York City attracted over 30,000 persons. Although there must have been many reasons to attract such a sizeable audience it may be said without fear of contradiction that there was one paramount reason in the minds of all those who attended the convention and that reason was to see what was new in the industry.

To learn of new developments in any industry is necessary to the success of those engaged in its trade. That this truism is appreciated by those concerned with the electronics industry was evidenced by the thousands who converged on the New York Convention from every state in the Union, from across the breadth of Canada and from many foreign lands.

In Canada the electronics industry has much to be proud of. In its short history it has achieved much and during the past few years of national rearming its contribution to our security has been second to none.

It is not only in the field of armament however, that electronics has a part to play. Its potential application to industry is so wide-spread as to be practically impossible of comprehension. It is because of this fact, we believe, that so many thousands attended the I.R.E. convention in New York, to see the product applications being manufactured by others, to learn of new developments in the fields of research and engineering. In short, to learn at first hand the progress of the industry in all its broad ramifications.

Here in Canada there is a similar job to be done for the electronics industry. The job of providing a medium for the exchange of information between the scattered facets of the industry and the task of maintaining liaison between the manufacturers and their prospective customers.

Predicated on the belief for such a need *Electronics & Communications* has been dedicated to serve the industry as an agent for the exchange of knowledge and to act as the Canadian industry's ambassador of the electronic age in more than 11,000 Canadian enterprises where electronics and communications is destined to better serve Canadians in the future.

Radar Inventor "Off The Beam"...

In a recent address to the Association of Professional Engineers of Ontario, Sir Robert Watson-Watt, the inventor of radar and top-ranking personality in the world of electronics, reportedly criticized electronic engineers and scientists for their lack of imagination and failure in finding appropriate industrial applications for the new man-made electronic slave they have created.

In our humble opinion Sir Robert was a little off the beam, so to speak. His criticism, it seems to us, should not have been directed at that segment of the engineering profession whose business it is to conduct research and delve into the theory of electronics. Rather, a better service on behalf of the electronic industry would have been performed had Sir Robert addressed himself to industrial management and plant engineers – the obvious end-users of this new electronic slave wonder – who now need to be informed of the thousand-fold increase in efficiency with which electronics can perform countless business and industrial operations.

It is perhaps safe to say that the development of electronics has out-paced the advances made by any other comparable science in the past. The speed with which electronic research has progressed in the years since the war has been so great that industry and business have not had time to assimilate its benefits. It is, indeed, our further belief, that business management and plant engineers across the broader field of business have yet to be made aware of the full significance of the revolutionary effect which electronics is destined to play in business and industry.

When plant managers, superintendents, engineers and presidents of Canadian business become aware of the fact that many things man is now doing in business and industry can be done better by the use of electronics, then a balance between research on electronics and electronic application in industry will have been struck.

The logical effect of informing such people as these with respect to the ramifications of industrial electronics and the earning power inherent in its use would be to have such men study every time and motion function in their plants with the object of seeking a means of doing the job better, cheaper and faster by electronics.

If, therefore, Sir Robert in his recent address had so informed business managements and their engineers, rather than reminding research engineers and scientists of something they must be only too well aware of, it is considered that a valuable step forward would have been taken in the matter of stimulating the application of electronics to industry.

FERRANTI COMPUTER
OUTDATES MATHEMATICIANS

CONSIDER the number of clerks it would require to perform 1,000,000 multiplications an hour then ponder the fact that the Ferranti Electronic Computer now installed in the McLennan Laboratories at the University of Toronto can do just this without blinking a tube, so to speak. As a matter of fact the Ferranti computer can do more arithmetic in one day than the average person can do in a lifetime, and without the same likelihood of error.

The Ferranti computer is perhaps the star example of just what electronics can be made to do for man. It is the shadow of coming events in the science of electronics which is revolutionizing industry in practically every field. There is little likelihood that instruments the size of the Ferranti computer with its 20,000 tubes and six miles of wiring will be purchased and installed by ordinary business firms, but its development and construction has made possible many applications of electronics to business machines which have resulted in the saving of thousands of dollars by those firms using them.

Engineering Problems Solved

The Ferranti computer now in operation at the University of Toronto is presently being used on complex calculations required for the design of the St. Lawrence Seaway. It will also be used for other types of computation including nuclear formulae physics, general engineering calculations, geo-physics, biology and astronomy.

Appropriately dubbed "electronic brains" these wonder machines, of which there are about seventeen in existence, have already proved their worth in the field of engineering.

At the Douglas aircraft works in California, engineers and designers had developed plans for a new type of aircraft to the point where they required mathematical proving. Following the reduction of the plans to formulae and equations mathematicians fed their problems into their computer. The answer when produced showed that there was a serious fault in the design of the wings. If the craft had been built as originally planned the wings would have fluttered. In the next eight months there followed a further 287 checks by the "electronic brain." When the final answer was produced the computer had redesigned the entire aircraft without error. Without the aid of the computer the work entailed in the redesign of the aircraft would have consumed years of effort by a large engineering staff.

Similarly, the Ferranti computer now installed at the University of Toronto on behalf of the National Research Council of Canada will be called upon in the future to solve the riddles standing in the way of Canadian scientific progress.

AS FAR AS THE OPERATION OF ITS FACSIMILE telegraph units are concerned, it will be possible to send telegrams from outer space if there is someone around to send them, the Western Union Telegraph Co. says. The company announced that high altitude tests of its new facsimile telegraph equipment prove that the machine works perfectly at 40,000 feet, and that it should operate equally well at a 100-mile altitude where outer space begins and air is so rarefied it is almost a complete vacuum.

One of the first TV sets to be made and sold in Canada was this 7-inch Admiral table model.

CANADA'S FIRST STEP IN TV!

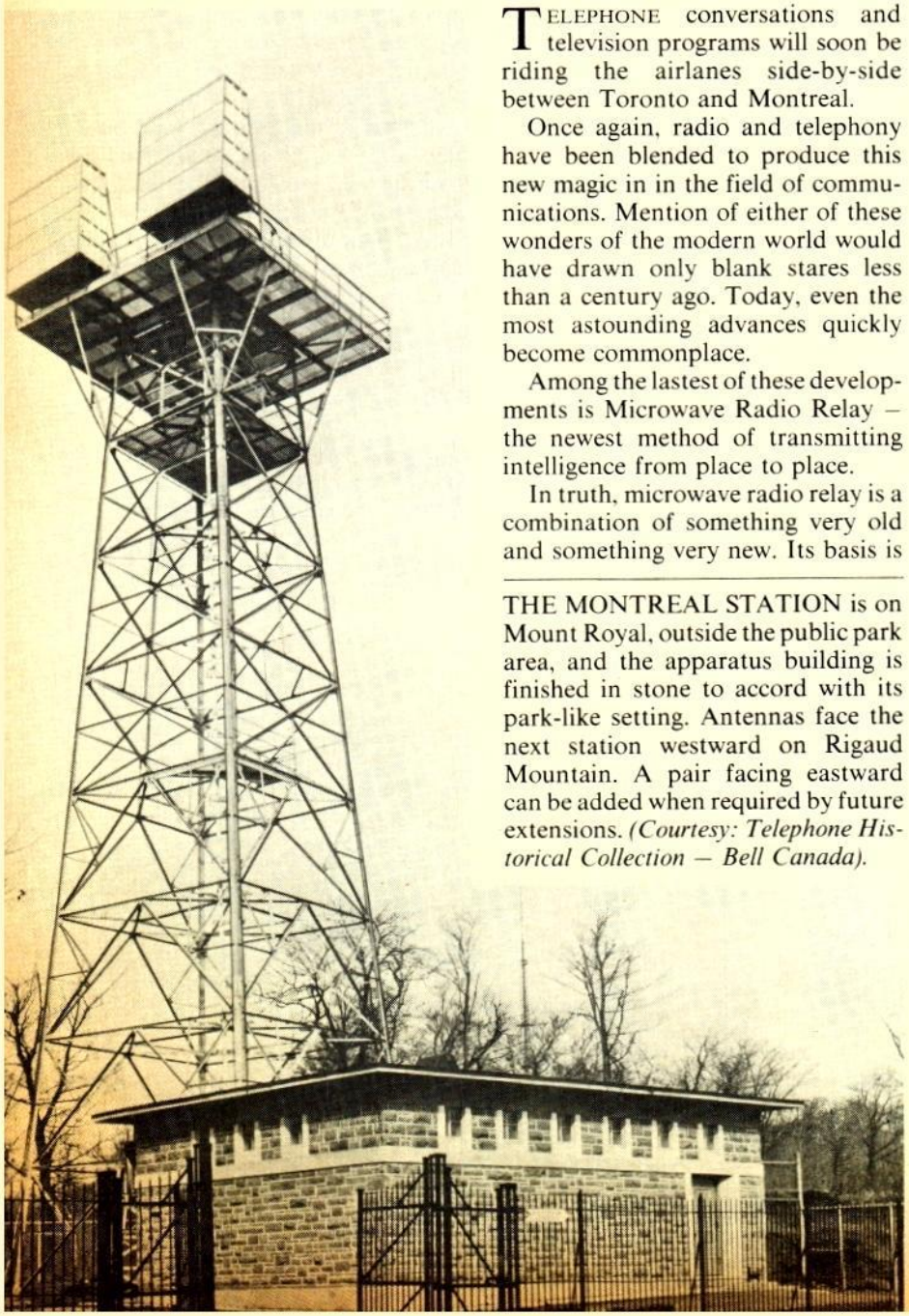
Linking Buffalo, Toronto and Montreal, Canada's New Microwave Network Will Bring Television To Many Thousands of Canadians and Increase Telephone Facilities Between Toronto and Montreal

TELEPHONE conversations and television programs will soon be riding the airlanes side-by-side between Toronto and Montreal.

Once again, radio and telephony have been blended to produce this new magic in in the field of communications. Mention of either of these wonders of the modern world would have drawn only blank stares less than a century ago. Today, even the most astounding advances quickly become commonplace.

Among the lastest of these developments is Microwave Radio Relay – the newest method of transmitting intelligence from place to place.

In truth, microwave radio relay is a combination of something very old and something very new. Its basis is one of the earliest principles in communications – the relay system of delivering messages to one place from another. Its technique is microwave transmission – the newest method of using radio as the messenger.



THE MONTREAL STATION is on Mount Royal, outside the public park area, and the apparatus building is finished in stone to accord with its park-like setting. Antennas face the next station westward on Rigaud Mountain. A pair facing eastward can be added when required by future extensions. *(Courtesy: Telephone Historical Collection – Bell Canada).*

Such a microwave radio-relay system, embodying the most modern principles of design, is now under construction by The Bell Telephone Company of Canada. The purpose of the system is to transmit telephone conversations between Toronto, Ottawa and Montreal and to deliver television programs to TV broadcasting stations being built by the CBC in Toronto and Montreal.

Work on the project is well underway. It was started following an announcement by the CBC in July (1951) that the Bell Telephone had been awarded a contract to provide a television network linking Buffalo, Toronto and Montreal.

12 Relay Stations

The Buffalo-Toronto link, a short leg requiring only one relay station between the two cities, will be ready to deliver U.S. network television programs to Toronto this year. The main Montreal-Toronto section, which will require 12 intermediate relay stations as well as terminal stations in the two cities, is scheduled for completion in the spring of 1953.

The programs transmitted over this network cannot be picked up directly by home receivers, of course. The microwave system will be purely a delivery network, relaying the programs from one city to another, where they will be converted to television frequencies and broadcast for home reception.

A relay network is as important to television broadcasting as it is to radio in order that programs originating in one centre can be broadcast simultaneously in others. Radio programs often travel thousands of miles by wire over these networks before making the short hops from local broadcasting stations to home receivers. But the problems of providing a television relay network, like everything else associated with TV, are considerably more complex because of the higher frequencies involved in transmitting the video signals.

High-quality telephone wires can

be used to relay sound programs between cities. But in television, it is necessary to provide facilities to transmit a broad band of frequencies ranging up to four megacycles, and at these frequencies the problems of transmission losses and other factors are magnified manyfold.

One method of transmitting these high frequencies over long distance is coaxial cable. Another and newer development, offering many advantages in both economy and efficiency, is microwave radio relay.

Trojan Flags to TV Towers

The microwave radio relay system being constructed in Canada was developed by Bell Laboratories. Similar systems are being installed on an increasing number of routes in the United States as a most economical and efficent method of carrying telephone conversations and television programs from point to point.

As previously mentioned, the principle of relaying messages from one post to another to speed their delivery to a distant centre is extremely old. It has been used in many ways.

The ancient Trojans relayed messages by a code system employing coloured flags flown from a chain of towers. When flags arranged to signal a message were flown at one tower, observers at the next tower would duplicate the display, and thus the message passed from tower to tower until it reached its destination. The warning of the Spanish Armada's approach was relayed inland from the English coast by a series of signal fires. Indians sent up smoke signals to relay their messages from point to point. The tom-toms carried messages across Africa, one drummer after another picking up the beat.

Some of these relay systems made use of sound, others sight, but they had one thing in common. All involved delays due to the human element. Man had to receive his message and then set his arrangements in operation to send it on its way.

The discovery and evolution of the uses of electricity opened the door to virtually instantaneous transmission and reception of messages anywhere in the world. Devices were developed which enabled electrical impulses to be received, amplified and transmitted automatically and instantaneously. These culminated in the invention of the vacuum tube which, among other things, made it possible to carry telephone conversations over long distances by amplifying the voice currents at intermediate points.

Today, given a new approach by the use of microwaves, relays serve communications again.

Line of Sight

These super-high-frequency radio waves have many peculiar properties. Like light waves, they can be concentrated into a beam, and the beam can be aimed like a searchlight. Again, they do not follow the curvature of the earth, unlike lower frequency radio waves, so the reliable range of the beam is limited to the line of sight, or the horizon.

In the Buffalo-Toronto-Montreal radio-relay system, the microwaves will be focussed by special antennae and beamed from tower to tower. Special amplifying equipment at each station will give them a million-fold boost in power before instantaneously shooting them on their way to the next station.

The 12 relay stations between Montreal and Toronto will be spaced from 15 to 35 miles apart. The receiving and transmitting antennae for each station will be mounted on a strong steel tower. These towers will range in height from about 50 to 225 feet, depending on what obstructions must be cleared to obtain a line-of-sight path to the next station for the microwave beam. The associated radio and telephone equipment will be housed in a building at the base of each tower.

The only relay station on the Buffalo-Toronto link will be located at Fonthill, Ont., about 25 miles northwest of Buffalo and 41 miles south of Toronto. The network will be able to transmit any United States television program available at Buffalo. They will be beamed from there to Fonthill, where they will be relayed to Toronto.

When the Toronto-Montreal section is completed, it will be able to deliver to Montreal any programs originating in Toronto, as well as relaying programs from Buffalo. In addition, a channel will be provided in the opposite direction to relay programs from Montreal to Toronto when this is required by the CBC.

Lake Ontario Trouble Solved

The work of selecting the relay station sites required about two months. Bell engineers used portable equipment for their field tests. This equipment included temporary towers, made up of eight-foot aluminum sections, which could be erected as high as 200 feet within a few hours and dismantled just as quickly.

The tower sections were transported from site to site in trucks, as was the associated transmitting and receiving equipment. The transmission paths between various prospective sites were tested by beaming microwave signals between saucer-like antennae of the parabolic reflector type, which could be moved up and down the towers to make tests at various heights.

The permanent towers will have huge horn-shaped antennae, each about 10-feet square and weighing about a ton. At each relay station, one of these big metal horns will gather in the microwave signals and will funnel them down a waveguide to amplifying equipment housed in the associated building. After getting a million-fold boost in power, the signals

(Turn to page 34)

AS A RESULT of Canada's mushrooming growth, Canadian public utilities have been pressed to the limit in their efforts to supply adequate service. Among the hardest pressed are the communications companies who during the years since the war have been striving to fill a backlog of orders for service far exceeding the carrying capacity of their installations.

With the completion of the new microwave radio-relay system now under construction by the Bell Telephone Company and stretching from just west of Toronto to Montreal via Ottawa, some considerable load will be taken off the company's taxed facilities.

The new microwave radio-relay system, more generally accepted as being for the sole purpose of carrying TV programs, will also transmit telephone conversations between Toronto, Ottawa and Montreal as well as deliver television programs to TV broadcasting stations being built by the CBC in Montreal and Toronto.

Servicing By Discard Foreseen With - - -

PRINTED WIRING

By G. F. Beaumont and E. A. Thomas

New developments in radio and television manufacturing which will eliminate the human error factor from major assembly stages and permit greatly increased production are being adopted by the Canadian Westinghouse Company. Engineers have been working on the new techniques for some months and they are being incorporated into regular production of some receivers.

The most important of these, termed "Printed Wiring", is a new method of radio chassis assembly which consists basically of replacing the conventional complex wiring by a metal foil conductor laminated on an insulating base material. All hook-up wire comprising parts of the circuit is replaced by metallic strips permanently fixed to an insulating plate in predetermined pattern, and components such as resitors, capacitors, I.F. transformers and tube sockets are assembled to the opposite side of the plate. Leads or terminals pick up appropriate points in the wiring through holes drilled in the plate. The base material of the printed wiring plate is generally a laminated plastic, thermosetting and not subject to cold flow, heat or temperature distortion. The dialectric consists of a paper or fabric base, impregnated and coated with a resin binder under high heat and pressure.

For the actual conductor pattern copper foil is used. The metal is bonded to the base and the bond must stand up under normal aging and to the application of temperatures of 500 degrees F. encountered during a later soldering process. Too great a bond strength can cause delaminating or cracking of the insulating material under thermal shock, due to the variation in coefficient of expansion between the metal and the plastic. The thickness of the copper foil is determined by the width of line to be used in the wiring pattern and the current it is required to pass. Overload current is fairly high for even narrow line widths but 1/32 in. line is the narrowest used. It has been found that a minimum spacing of 1/32 in. between adjacent conductors should be maintained in order to prevent solder bridging between conductors during later stages.

Size Limitation Factors

The designing of a standard 5-tube unit, covering the broadcast band only, provides a good example of a printed chassis. The first problem encountered will be to determine the approximate overall size of the printed wiring plate and several factors will decide this point. Cabinet design will determine its maximum dimensions and the size and quantity of components to be mounted will govern the minimum. It has been found that large or bulky components should not be mounted on the plate. Those such as the gang and speaker are better fixed to a metal chassis which will provide a firmer mounting. With only the smaller components mounted to the plate a thickness of 1/16 in. is suitable.

Crossings Pose Problem

Laying out the components in the approximate position they will occupy on the final plate is the next step. With the prefabricated wiring process, wires cannot be crossed easily but several methods have been devised. One of these utilizes wire bent into the form of a staple and inserted in the same manner as a resistor or capacitor, through holes punched in the plate. Other steps in the layout follow the same pattern as conventional wiring. "Hot" leads are kept as short as possible, and high stray capacities between leads and couplings from certain components are avoided. When the wiring pattern is finally laid out, it is then transferred to a black and white drawing from which a photographic negative is made. Using the photo-negative technique or a silk screen process, the copper which will form the wiring pattern is covered with an acid resistant solution. The entire plate – the base with the sheet of copper foil bonded to it – is then immersed in an acid etching solution. The pattern protected by the acid resistant solution remains when the plate is removed while the surplus copper foil is etched away. Thorough cleaning then removes any etching or acid resisting solutions.

Several methods may be used to prevent oxidation of the copper which would make later soldering difficult. The copper may be plated with silver immediately after etching or coated with solder. If the latter technique is used the complete plate is dipped in molten solder or the solder may be electroplated to the copper. Punching of holes for mounting components is the final operation in preparing the plate. Following this, the special type tube sockets used are inserted in the holes provided and keyways are provided for correct orientation so that proper wires are picked up. Resistors and capacitors are next mounted with their leads placed through appropriate holes and other components follow.

Dip Soldering

The method used to solder connections between components and the wiring pattern is another example of advance manufacturing technique. By conventional means, these would be done by hand but the new "dip soldering" saves a great deal of time. The side of the plate bearing the wiring pattern and connections is dipped into a bath of molten solder after fluxing and all connections are completed in the single operation. Care is taken to prevent any deterioration in the bond between the copper and the laminate by accurately gauging correct immersion time for the type of insulating material used. Temperature of the solder bath is

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No More Broken Thumbs - - -

Machine Drives 1440 Nails Per Minute!

Just where the industrial application of electronics is likely to end is a question which would be difficult to answer at this time. In trade periodicals and company announcements new applications of this discovery are being made known daily. Now electronics are assisting in the performance of functions which only a few years ago were considered to be operations that could only be executed satisfactorily by the hands of men. These same operations now aided by electronics, are being carried out with a speed and precision which leaves manual manipulation miles behind.

1440 Nails Per Minute

Who, for instance, only a few years ago, would have thought that the age-old manual chore of driving nails would be performed mechanically and controlled by electronics. Such, however, is the case with a nailing machine now being manufactured by the G. M. Diehl Machine Works of Wabash, Indiana. The machine has an electronic control which permits the selection of ten different nail patterns. Up to 1440 nails ranging in length from one inch to 3½ inches can be driven in one minute. The new machine is actuated with a "push-button" operation and is completely controlled by electronics and powered by hydraulics.

This innovation in nailers is called the HYDRONIC NAILER.

Extreme simplicity and precision action of the new NAILER is particularly important to all industries manufacturing packing crates, boxes, skids, reels, pallets, and all the other wooden devices so vital to the shipping of good and products.

The "push-button operation" feature of the new NAILER is centred in an electronic master-control panel within fingertip reach of the operator. By flicking pre-selected switches on the panel, the operator trips high-speed solenoids for positive, split-second picking of nails from the feeders to nail chucks. On the 72-inch model, up to 24 nails and 10 patterns can be used in any combination. Push-buttons also control the raising and lowering of the work table.

After selecting specific nails and patterns, the operator touches a pedal, which lowers the powerful hydraulic drivers – up to 60 strokes per minute – with steady, straight-down pressure, penetrating the hardest woods. Nail-bending is substantially reduced, and no pre-drilling is necessary.

New Features

Another feature is the diagonal thrust clinching action. Hardened-steel clinching blocks synchronize a sideward movement with an upward

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Industry veterans recall 1953

E & C sought out some veterans of the electronics industry who were beginning their careers thirty years ago. If you were one of them, these recollections will stir up memories of electronics' fledgling years. For various reasons, some of the retired industry leaders of 1953 could not be interviewed. Among them were Milt Stark, J.R. Longstaffe, and Dr. Sinclair. All of those who reminisced for us are still active and working full-time — except Jim McDaniel, who retired just recently.

ART AINLAY

The spring of 1953 found Art Ainlay working for Canadian Westinghouse Ltd. in Hamilton as the engineering manager of its electronics division. Later in the year, he moved to Rogers Majestic where he marketed the ferrites patented by the Philips of Eindhoven parent firm.

Now the president of Leecraft Industries Ltd. in Toronto, Ainlay best remembers the people he worked with in those days. Men like Jack Leech-Porter, recently retired ("he still plays tennis"), Bill Cheeseman, who became president of Westinghouse and was later killed in an auto accident, and John Houlding, manager of the electronics division of Arctic Gas.

He recalls, too, that 95 percent of the electronics products Westinghouse turned out had a military orientation. Among them were the velvet glove missile and underwater weapons for the Canadian Navy.

"It was an exciting, complex time. The Government had money to spend and unlike today, they spent it on defence."

The industry's emphasis was also on radio and black and white television which was just becoming readily accessible.

"In those days, electronics was remote from most people's lives. Now colour television is commonplace and electronics applications touch every aspect of daily life. I'm talking about computers, robots, CAD/CAM, information transfer and much more. There's been an explosion in the past 30 years and we still haven't experienced all its effects."

AL ASKEW

Al Askew, president of Renmark Electronics Ltd., remembers 1953 as the year J.R. Longstaffe ran for Parliament.

"That was the big event of the year all right, even though it had nothing to do with business."

At the time, Askew was working for Longstaffe, then president of a group of companies which later became Renfrew Electric.

"Don't ask me what my title was. The old man didn't believe in 'em. I was hired as advertising manager but I got involved in a little bit of everything – purchasing, sales, personnel. Whatever he needed, I did it."

When Longstaffe decided to carry the Liberal Party's colours in the Toronto riding of Eglinton in that year's federal election, Askew took a leave of absence and got "heavily involved" in working for him. Unsuccessfully as it turned out – Longstaffe lost to Progressive Conservative incumbent Donald Fleming, later Finance Minister in the Diefenbaker cabinet – but the experience was "interesting", he says.

1953 was also the year that Renfrew introduced Struthers-Dunn relays and Amphenol connectors ("they're still making the relay lines").

"It was an exciting time to be in the electronics business. Of course, that was long before the advent of any major computer activity. The television market supplied our big customers."

JOE BASS

"There was a real sense of excitement in 1953," says Joe Bass. "We were on the threshold of a new era with a giant market just starting to awaken."

The president of Atlas Electronics Ltd. was then responsible for western Canadian sales for the firm's predecessor, Atlas Radio. He was based in Winnipeg, where he had attended school before moving on to Chicago and Los Angeles.

Casting back 30 years brings to mind the Chicago Parts Show ("the Canadian group always brought the Crown Royal which wasn't available in the States"), as well as friends and business associates too numerous to mention. "It's amazing how many are still active, keeping distribution in Canada viable today."

Bass says it was a "fun time".

"It was a new industry and we felt like pioneers. Every year brought new technologies and new products. We never knew what to expect but nothing surprised us."

In retrospect, though, he says the industry hasn't really changed much in the interim.

"Oh, the volumes are greater and some products are different. And, of course, a lot of the names and places have changed. But the way products move to market is the same. A lot of distributors are still around, too."

LEN FINKLER

The infant electronics industry was magical, says Len Finkler, looking back to early 1953. "We were awfully young and had no idea of the impact it would have on our lives but we knew it was a special time."

The president of Len Finkler Ltd. was sales manager for Electro-Sonic Inc., 30 years ago. "I dabbled in sales and was pretty amateurish," he laughs. "But times were good and we

had a terrific dealer business."

The company sold many television antennae (the "Dragnet" model, named for the TV show), as well as power transformers, signal diodes and tubes.

"Transistors weren't marketed at that time and capacitors were called condensers. Most of our sales were to dealers but the industrial business crept up gradually and we went after it in a big way around 1953."

Finkler remembers many great personalities from that period.

"Men like Jim Christie (now deceased), who was general manager of Electro-Sonic, and I. Rosenthal, the president and Chairman of the Board. He gave me a lot of encouragement. I also recall sweeping floors with Colin MacKenzie, now president of Electro-Sonic.

"The business was completely different then. I was an expert on tubes and now we're into digital electronics. In some ways, the changes have been difficult to adjust to."

COLIN MACKENZIE

The fledgling electronics business was booming in 1953, recalls Colin MacKenzie, then store manager for Electro-Sonic Inc. in Toronto. The intervening 30 years have been good ones, too – today, MacKenzie occupies the firm's presidency.

"I was in charge of the sales counter in those days, handling electronics components. Television was in its heyday – it was a growing industry with plenty of action."

Most of MacKenzie's colleagues at Electro-Sonic are still there though a few, like Len Finkler, then Electro-Sonic's sales manager and now president of Len Finkler Ltd., have moved on. He remembers work being a challenge and "a lot of fun."

"Business was mainly made up of dealer service work as opposed to industrial components supply which is our bread and butter today. It's the difference between television components and parts used in factories."

Although the landscape of the electronics industry has altered dramatically in the past 30 years, MacKenzie says one thing is unchanged:

"People still want good service and value. If they get it, they'll keep coming back. That was my philosophy in 1953 and it still is today."

JIM McDANIEL

"Technology was so simple 30 years ago," recalls Jim McDaniel, recently retired as director of sales for CNCP Telecommunications. "We didn't dream of microwave communications then and our telegraph lines across the country were subject to all the uncertainties of the weather."

In those days, McDaniel says that winter storms regularly knocked out telegraph poles, shutting down communications across Canada for a day or longer. Moreover, weather problems and the Aurora Borealis (Northern Lights) caused great voltage fluctuations, wreaking all kinds of havoc.

1953 found McDaniel working as plant chief ("really a high grade central office technician") at the headquarters of the Canadian National Telegraph Company. The firm later merged with CP Telegraphs to become CNCP Telecommunications.

"The whole central office occupied the 12th floor of a building at Bay and Temperance streets downtown. Now, the company needs more space just for the employees' lockers."

He remembers working with Edmund Peachy, then supervisor of operators at CN Telegraphs. When Peachy left the company in 1953 to start his own business "we thought he was crazy." Peachy went on to found the Valhalla Inn chain and become a millionaire.

"It's hard to believe how much has changed since then," McDaniel says. "In 1953 there was no computer communications service per se and no data communications in Canada. It's been a period of fantastic growth and the most exciting time is still to come."

MICHAEL ROSENTHAL

1953 was a milestone year for Michael Rosenthal – that's the year he succeeded his father Jack as president of Cesco Electronics Ltd. of Montreal.

"At that time, we sold everything in the electronics field. Of course, that's impossible today because the business has expanded so wildly. We concentrated mainly on consumer products, such as radio and television accessories, hi-fi and the like, whereas now we're into the industrial end of things."

He remembers putting out comprehensive catalogues of all the company's products, unlike today when we put out a single catalogue just for switches."

The electronics industry was volatile, stimulating and constantly exciting in 1953, with "never a dull moment," Rosenthal says. "In that sense, it hasn't changed a bit. It's just as dynamic and creative today."

One thing that has changed is the personalities.

"A lot of small companies were in operation back then and many of them have since disappeared. I remember A.C. Simmonds – one of the finest men to work in the industry – along with Len Hammond, Lou Harris, and others too numerous to mention."

BRUCE VALILLEE

1953 was a "kick off year" in the electronics business, remembers Bruce Valillee, manager of marketing and sales with ITT Cannon Electric of Canada.

"I was working as a salesman for the International Resistor Co., a division of J.R. Longstaffe Co. "Things were starting to jell and business was on the upswing."

The component industry, which had started during the Second World War, was sustained by burgeoning radio and television sales. Many of the issues affecting electronics – research and development, government assistance – were the same as today, he says.

"But business was a lot more fun. A salesman making his rounds in 1953 got to know everyone and everything that was going on. In the computer world we live in today, there's not much time to talk to people and observe what's happening."

Valillee says it was impossible for many firms to export goods in those days because they operated as licencees. "We relied on the domestic market and it sustained us. But Canada doesn't have a manufacturing base today so we're export oriented. If we depended on domestic sales we'd have to close down."

This Space

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of selling paper to customers who wanted to be sure they were getting what they paid for this method was not good enough. Thus the development of the Papric Dirt Counter. With it, the process which used to take hours to perform, and at the best resulted in a count that was highly susceptible to human error, is now carried out in seconds.

Having seen this machine we got to thinking about it and it became apparent to us that the instrument . . . or a modification of it . . . might be used by medical authorities in the science of hematology, the process of determining human blood counts.

Being interested in this possibility we arranged to witness a blood test being done in a hospital and despite the confusing talk and jargon of the laboratory technicians who spoke to us knowingly of plasma to blood proportions, differentials, sedimentation rates and platelet counts we're still convinced that this medical chore could be done some way or another with an electronic gimmick like the Papric Dirt Counter.

It's just an idea of course, but one we feel that has possibilities. Maybe the engineers at Electronic Associates Limited, the people who developed the Papric Dirt counter, could give the thought some consideration. If any one happens to make any money out of this idea we'll settle for ten per cent.

A Word To Management

In this piece we just don't seem to be able to get away from the subject of ideas. Ideas are pretty important things though and without them we wouldn't progress very far.

Today industry and business are blessed as never before with the possible means of doing their respective jobs better. Contributing largely to this situation is the fact that electronics is capable of performing many operations better, cheaper and faster than ever before. Although there are many known functions which can be accomplished by electronics there are many more which, as yet, have not been thought of. It is of these that we would like to say a few words.

To begin with we'd like to point out that it is not necessary to be an engineer to ask yourself if some operation in your plant can be done better with electronics. All you have to be is curious, to wonder if some certain part of a process in your plant can't be done faster, controlled better, or performed cheaper. Electronic engineers or specialists who are readily available for consultation can soon tell you whether your idea is feasible. All you have to do is ask the question. Others have done so and saved themselves thousands of dollars a year.

Today in Canada there is hardly enough manpower to go around. Compensating for this however, science has provided us with a medium which, if intelligently applied, can relieve people from hundreds of tasks which can be done better electronically, permitting them to be absorbed and used in other more satisfying forms of work where they are badly needed. Business management owes to itself therefore, the necessity of becoming electronically minded for the mutual benefit of industry generally and the welfare of the country.

Tom Lazenby

Canada's First

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will be sent up through another horn and beamed at the next tower.

These special lens-type antennae will focus the microwaves into a narrow beam so efficiently that less than a watt of power – about the amount required to light a flashlight bulb – will be needed to span the distance between two stations.

Because there will be two-way channels between Toronto and Montreal, each relay tower along this route will have four antennae – two facing in each direction.

Only a one-way channel will be provided initially from Buffalo to Toronto. However, the relay station at Fonthill will beam signals to Toronto at two different frequencies simultaneously to overcome fading which would be caused by reflection from Lake Ontario under some conditions.

This fading problem was discovered while testing between Fonthill and Toronto. It was found that the lake tended to act as a reflector, causing interference which resulted in fading of the television image. The problem was solved by a fortunate quirk of microwave transmission. It was found that signals transmitted at different frequencies do not fade at the same time from this cause. The television signals will therefore be carried on two frequencies and special equipment in Toronto will automatically switch from one frequency to the other as reception changes, thus keeping the signals at the highest quality.

Could Carry 12 TV Programs

Because of the early date scheduled for the Buffalo-Toronto section to be completed, temporary equipment will be used at first on that route. This equipment will include parabolic-reflector type of antennae. However, permanent towers with lens-type antennae will be constructed in the meantime at Fonthill and Toronto and will replace the temporary equipment as soon as they are ready.

The radio-relay system is designed to operate on a frequncy band ranging from 3,700 to 4,200 megacycles, where the wave length is about three inches. On the Toronto-Montreal route, this would make six broad-band channels available in each direction. Initially, however, it is planned to install facilities for two television channels (one in each direction) as well as for 60 additional telephone circuits between Toronto and Montreal, 12 between Ottawa and Toronto, and 12 between Montreal and Ottawa. Additional facilities can be installed as required, and the Toronto-Montreal network will be potentially capable of carrying as many as 12 television programs or thousands of telephone conversations simultaneously. The same facilities that will carry television programs also can be used to carry telephone conversations.

The relay system was fundamentally planned by Bell to provide for future growth in the number of its long distance telephone circuits between Montreal, Ottawa and Toronto. It was estimated that by 1954, the number of circuits which could be made available with existing cable facilities would be insufficient to handle the telephone traffic on these important routes. In addition, the relay system affords an alternative long distance path not associated in any way with the cable routes.

1953

It was year 8 since the first atom bomb was dropped on Hiroshima. A giant uranium deposit was found this year in Algoma, Ontario.

Josef Stalin died in March at age 73.

President Eisenhower had taken office in January, succeeding Harry Truman.

Queen Elizabeth II was crowned in June.

An armistice was signed, ending the Korean War in July.

Louis St. Laurent and the Liberals won the general election in August.

Playboy and TV Guide both began publication in this year.

In sports, the New York Yankees won the World Series, and Ben Hogan was the US Open winner.

At Stratford, Ontario, the Shakespeare Festival opened for the first time in a tent.

Air travellers boarded the first new Vickers Viscount turboprops and Douglas DC-7s.

Electronic beginnings

In electronics, TRW Inc. had its beginnings and Litton Industries was founded, both in California. IBM introduced the 701, its first computer. R-O-R Associates, a distributor in Toronto, started in business.

TV set sales in parts of Canada were booming. The Buffalo-Toronto microwave relay link that would carry US network TV programs was completed. CRT production was expanding, and a new technique for dip-soldering chassis was introduced to TV set production lines. A few months later, PCBs were incorporated in radio and TV chassis.

Transistors were four years old and GE was doubling production of germanium diodes at its NY plant.

Telephone and long distance business was growing by leaps and bounds. The RCAF ordered $150 million-worth of electronic equipment and a 6-ton Ferranti computer started operation at the University of Toronto.

The 41st annual IRE convention and an Electronic Parts trade show in the US were big events for the attending Canadian engineers and distributors.

Many of us in this industry remember the 50s fondly.

J.R. Longstaffe had a couple of salesmen who are now executives with Renmark and ITT Cannon. The western regional sales rep for Atlas Radio is now president of that company. Electro-Sonic had a sales manager who is president of Len Finkler Ltd. A telegraph messenger boy had been promoted to the sales department of CNCP Telecommunications. He later became the spokesman for telecommunications services in their TV commercials.

Realities of tomorrow

A new Canadian business publication was the first to serve the electronics and communications industries "as an agent for the exchange of knowledge and to act as the Canadian industry's ambassador of the electronic age".

New *Electronics & Communications* editor, Tom Lazenby, was somewhat of a prophet and philosopher. In this pioneer issue, he wrote: "Who today is bold enough to prophetically declare that the fantasies of today will not be the realities of tomorrow? Now with the comparatively new science of electronics the horizons for future development appear to be limitless".

"Electronics is capable of performing many operations better, cheaper and faster than ever before".

"Science has provided us with a medium which, if intelligently applied, can relieve people from hundreds of tasks which can be done better electronically".

In a 1953 feature article entitled: "This Electronic Age", Lazenby predicted it would not be long before even small offices can employ electronic means to keep business accounts, run continuous sales records, compute and send out bills, maintain running inventories, fix production schedules, serve as vast filing systems and chart corporate expansion. "It is almost a certainty that an eruption is about to take place because the office is ripe for revolution".

It has all happened, and more.

This, despite government intervention when not needed, or the lack of it when it was needed.

Coherent policy

Canada's industrial strategy has been described as "incoherent". In 1982, a discussion paper for the Economic Council's research into technological change, productivity and growth – by Michael Bliss, a University of Toronto historian – said the notion that Canada had, has or ever will have a single coherent industrial policy is fantasy pure and simple.

"In the realm of industrial policy", the paper continued, "we have to learn to live with diversity, *ad hoc*ery, and a certain amount of disorder".

Whether "Canadian prosperity is a legacy of visionary, effective government economic management, or . . . a testimonial to the triumph of Canadian resources and enterprise over political mismanagement" is a moot point.

"Perhaps the net effect of Canadian industrial policies is to have made the Canadian people poorer than they would have been had they been far less governed".

"We may never be able to walk in a straight line towards our goal, but it will surely help if we stop walking in the dark".

How could Tom Lazenby have forseen, some twenty-five years later, government inertia would lead to the forfeiture of all Canadian production of radio and TV sets, picture tubes and most of their components to international competition? This happened despite an all-out, continuing effort by the consumer electronics industry, its association and unions to alert the federal government to the very real dangers of the fast-growing imports.

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1953

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Branch plant operations

However, the late domestic consumer electronics industry may have been guilty of one serious error:

In a recent brief on R&D to the minister of state for science and technology, the Canadian Council of Professional Engineers points out that one factor affecting our R&D level is the presence of numerous foreign-owned companies in Canada. "These branch plant operations usually rely on their parent companies to do any R&D work and consequently spend little money on it themselves".

Most of the late-lamented Canadian TV manufacturers were branch plants that found it expedient to let their parent perform all or most of the R&D.

The CCPE brief also notes: "We have a tendency to think that our country is not really a part of this technological scene, that other countries do all of this innovative work. And yet, many of the things we use either originated here, or were improved by Canadians. In the fields of electronic communucations, housing and air transport we are considered to be world leaders. In other areas, we have produced some remarkable inventions ranging from the snowmobile... to the Canadarm that stretches out into space with each flight of the space shuttle".

"Despite our successes of the past and current efforts notwithstanding, Canada has two weaknesses when it comes to R&D – developing our ideas and marketing them. Time and again people from other countries have taken our brainwork and done more with it than we have. The time has come for Canadians to start using our research and development expertise more effectively so that we no longer miss out on its economic benefits by default".

Reason for optimism

Telecommunications and space satellite products have now become the Canadian electronics industry's strongest element. There is some reason for optimism that the production of semi-custom chips and "office-of-the-future" products will soon be additional new areas of specialization in Canada.

Perhaps, thirty years from now, another editor of an electronics journal will be privileged to look back and report that Canada has not just learned to live with disorder in the realm of industrial policy, but has risen above it.

Experts say we are on the leading edge of a new technological wave. Let's hope we can ride with it and win!

Denis Olorenshaw

Printed

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another natural consideration but much experimentation was necessary before completely satisfactory results were obtained. Temperature and time of immersion will affect the amount of bridging between adjacent conductors and this is another point for careful observation. This dip soldering technique is admirably suited to completely automatic process and a number of machines have been designed to handle plates quickly. A much more uniform product is one important result with any chance of connections being missed or incorrectly made eliminated.

All that remains is to connect the large components. At the moment this is done by conventional means – wiring them into solder lugs provided on the prefabricated plate. Before this step the plates may be checked on the line by feeding in the required voltage and picking up the various test points. Another advantage of this prefabricated wiring is that stray capacities in the circuit are constant from plate to plate. This means that pre-aligned components such as I.F. transformers may be used to eliminate the need for trimming the I.F. circuits on the completed plate. If this does not quite work out then only a small amount of adjustment should be necessary which still greatly reduces production time.

Servicing By Discard Foreseen

Regarding servicing, engineers feel that the time may not be far off when greater production will make it economically feasible to simply discard an unserviceable plate and replace it with a new one.

The replacement of capacitors, resistors and other components does not present any problems. With I.F. transformers, the method of mounting allows the unit to be removed quite easily for replacement. Larger components, which have been wired in by conventional means, are replaced by the normal method.

George F. Beaumont and Ernest A. Thomas, the radio and television engineers principally responsible for these developments at Westinghouse, feel that with the larger chassis and greater number of components involved in a television receiver the prefabricated wiring development will be applied in the form of several sub-assemblies connected together to form the completed circuit. Sections such as the I.F. strip, sweep circuits, etc. would be very suitable for the method. They state that it may be some time before a completely prefabricated wiring chassis is developed for television but expect to report progress along that line before very long.

Machine

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movement, assuring a true bending of the nail which sinks it firmly into the wood, flush with the surface. When desired, the clinching action is easily disconnected.

The advanced design of the new NAILER greatly reduces set-up and adustment time, providing a smoother and more rapid flow of precision-nailed material. The solenoid selectors operate with equal efficiency on any size, type, or gauge nail – 2d to 16d – no rotary discs are employed to become jammed or to require constant changing. Four different size nails may be used simultaneously. The only accessory changes on this nailing machine – to handle different size nails where a wide variance in nail sizes is used – are the easily-switched sets of nail chucks and the simple adustment of the nail-feed tracks with a single control knob.

Diehl plans to manufacture the new HYDRONIC NAILER in open and closed back design, sizes 40 in., 48 in., 60 in. and 72 in.