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Japan Report

(FOUO 11/81)

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JAPAN REPORT

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SCIENCE AND TECHNOLOGY

PROGRESS OF FIFTH GENERATION COMPUTER DURING NEXT 10 YEARS OUTLINED

Tokyo DEMPA SHIMBUN in Japanese 9 Dec 80 p 1

[Summary of a report by the Japan Information Processing Development Association: "The Fifth Generation Computer: Development of a Prototype--Attainment in the Early 90's"]

[Text] On 28 November the Japan Information Processing Development Association, Inc. held a conference on "Fifth Generation Computers: Their Needs and Developmental Problems--Interim Report and Discussion" at the Machinery Promotion Association Building. Based on its plan for the development of a new computer system (the fifth generation computer), which is projected to be in practical use in the 1990's, the Ministry of International Trade and Industry [MITI] has established the Fifth Generation Computer Research Study Committee (chairman--Tatsu Motooka, professor in the Department of Electrical Engineering, Faculty of Engineering, Tokyo University) within the Association. At the conference, the committee made an interim report on the accomplishments of research and investigations now in progress. At this conference, each of three divisions, (1) The System Generation Technology Research Division chairman--Karatsu Hajime, Executive Director, Matsushita Communication Industrial Co., (2) Basic Theory Research Division (T Division, chairman--Kazuhiro Fuchi, chief of the Pattern Information Division, Electrotechnical Laboratory), and (3) The Architecture Research Division (A Division, chairman--Hideo Aiso, professor of Electrical Engineering, Faculty of Engineering, Keio University), made its own interim report and introduced the outlines of the fifth generation computer.

Development of High Speed Support Machines Based on the New Architecture

In the world computer industry IBM has held the leadership to the present, and the greatest task has been how to compete with IBM. However, at least in the hardware aspect, domestic computer makers have achieved a technical level that can stand comparison with IBM. Consequently, it has become necessary for domestic makers to independently establish their targets for the next step and to manufacture the equipment themselves. This fifth generation computer system takes as its objective "a new computer system that overcomes the technical limitations of present computers and copes with the high level functions required in the 1990's, and that is based on innovative theory and technology." Specifically, the aim is to complete the development of a prototype by the early 1990's through each step of research and development of constituent technology and trial design of the system.

Here is an introduction to the "story" until the 1990's.

Basic Theory Research Division

The configuration of the final targets for the fifth generation computer will be determined on the basis of the achievements of research attained by 1985. By 1990, the construction of the more sophisticated interim target prototype machine, adjustment between each sub-system, construction of the hardware system, and integration of the system will be completed.

Basic Software System

Configuration of the support system for the design and construction of the knowledge base, the final configuration of the intellectual programming system, and the final configuration of the system description language are to be determined, and necessary hardware will be produced accordingly.

Basic Applied Software System

In the case of the "speed recognition system" and the "diagram and image recognition system," necessary hardware will be produced and their functions are to be improved to a high degree. In the case of the "natural language comprehension system," a large-scale Japanese language dictionary and sentence structure rule base are to be compiled, and subsequently second phase targets are to be set. For the "machine translation system," coverage of the vocabulary is to be expanded with the focus on the strengthening of the function of analyzing meaning of words and sentences and the second phase target system will be realized. In the case of the "knowledge utilization system" and the "signal recognition system," improvement of performance is to be attempted by providing the systems high level knowledge and learning functions, and only after this are the second phase target systems to be produced.

Architecture Research Division

(1) Based on a new architecture, emphasis will be placed on development of machines that support deductive computation at high speed. By making these new machines the core and expanding the network of dispersed function systems completed by that time, speeds fast enough to be able to utilize the software for processing knowledge and information (the fifth generation software) are to be obtained. Machines based on the new structure will be connected with this network, and evaluation and the development of software will be carried out.

(2) Most of the parts for these machines will be converted to very large scale integration.

(3) A local network portion of the dispersed function network completed by approximately 1985 will grow and expand into a network that takes as its core machines based on the new architecture. In addition to primary cities in Japan, the network is to be connected with overseas points as well.

9712
CSO: 4105

SCIENCE AND TECHNOLOGY

LEAKAGE DETECTION BY ACOUSTIC EMISSION AT NUCLEAR POWER PLANTS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 59

[Text] *The Central Research Institute of the Electric Power Industry has been studying feasibility of a leakage detection technique that utilizes sound created when a liquid or gas leaks, in order to check the failure of piping systems in nuclear power stations. The following is a summary and results of their investigations.*

In the case when a crack in a piping system develops and expands to cause leakage, the liquid or gas will blow out violently due to the pressure difference between inside and outside of the piping. At this point sounds being a broad-band frequency are generated and travel along the solid portion of the pipe in both directions. Consequently, sound detectors properly spaced on the piping theoretically can detect the failure, and moreover by taking advange of the sound decrease during propagation, can approximate the location of the leakage by the dampening ratio.

The findings of the experiments are as follows:

(1) Characteristics of leakage sounds: For the most part LWR piping in use conveys high-temperature, high-pressure water and steam. The experiment showed that the sound intensity of a leak of saturated steam or high-temperature high-pressure water increases with the increase of the amount leaking. In addition, the sound spectrum ranges over 1MHz.

(2) Propagation of a leak's sound: The dampening of a leak's sound differs from place to place; the amount per unit length in the neighborhood of point of leakage is greater than for the rest of the pipe. Further, the amount becomes even greater in the higher frequency range, and the pipe containing liquid dampens more sound than in the case of a gas.

(3) Attachment of conducting rods to the piping: Acoustic properties of conducting rods are that the dampening difference in the different length of rods is negligible, whereas the diameter affects the property rather greatly, resulting in a sudden dampening increase as the diameter becomes less.

To connect conducting rods, although welding is the easiest where avilable, a high-temperature adhesive has been developed for the zones in which welding heat is too severe to permit. The sound propagation performance of the adhesive proved in the test to be almost equivalent to that of the welding method.

(4) Leakage monitoring system: For monitoring leakage signals in experimental equipment, detectors are not required to be under constant or simultaneous surveillance since the signals are continuous. Instead, it is considered perferable that devices are sampled and analyzed at certain intervals, and then the results are compared with standards (a background noise without leakage) so as to obtain any deviation which could evaluate possible leakage as well as its size.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW SEMICONDUCTOR RADIATION DETECTOR

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 59

[Text] *Toshiba Corp. has succeeded in preparing a low-cost, highly-sensitive, non-bias semiconductor radiation detector that can be used at normal temperatures.*

Semiconductor detectors employing silicon or germanium have high resolving power so that they are widely in use for activation analysis, X-ray fluorometry, and nuclear structure studies etc., being referred to as typical radiation detectors. However, conventionul semiconductor detectors all require a high bias voltage, but the worse drawback is that they require cooling in liquid nitrogen, which presents difficulties if used for X-ray therapeutic equipment such as radiography and X-ray CT.

The newly-developed instrument utilizes high-purity silicon with an impurity concentration of about 1/10,000 of that used for conventional IC's, in order to provide a surface-barrier type detector that builds a non-bias, cooling-free element. This has enabled its application for X-ray therapy.

The new device is shown in the figure. a high-purity silicon surface with a specific resistance of 2.5kΩ·cm is deposited with a thin silicon oxide film in the order of 50Å and further with gold on the film to form a surface barrier.

CSO: 4120

SCIENCE AND TECHNOLOGY

DEACTIVATION OF NUCLEAR POWER REACTORS BY UNDERWATER CUTTING, DISASSEMBLING

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 58

[Text] * The Ministry of International Trade and Industry as well as electric power companies is proceeding with the study on the technical feasibility of decommissioning nuclear power reactors, and Tokyo Electric Power Co. has announced plans to dismantle used reactors through underwater cutting techniques. According to the company, highly radioactive, aged reactors can be dismembered under water for storage in casks by means of plasma arc, water jet, and other welding methods. Such underwater dismantling technology is being developed in the U.S., West Germany and Japan, with apparent promise for practical use. The immersed cutting operation is intended to prevent workers' exposure; after dismantling, chunks are placed in the cask for storage or burial. The MITI will conduct reliability tests on reactor dismantling treatment in next fiscal year, in order to probe its feasibility.

CSO: 4120

SCIENCE AND TECHNOLOGY

10M TEST SYSTEM FOR ULTRA-CONDUCTIVE AC TRANSMISSION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 pp 54, 55

[Text] The Electrotechnical Laboratory has completed an ultra-conductive transmission test system which permits transmission tests to be performed using a cable only 10m in length, and has experimentally, made an AC ultraconductive cable using Nb_3Sn tape. This is a great stride toward testing practicability.

The laboratory had conducted a transmission test with a 2m long model cable using Nb_3Sn tape, with successful transmission at a maximum constant surface current density of 1,010A/cm. On the basis of this success, the laboratory has manufactured experimentally a 10m long cable with adequate improvements made in the Nb_3Sn tape to largely reduce AC losses.

1. Outline of Ultraconductive Transmission Test System

The test system consists of an ultraconductive cable case (horizontal cryostat), a current supply terminal (vertical cryostat) and power supply to supply current.

The cable for the test system has been made in simulation of a practical structure presumed for the ultraconductive cable.

A cylindrical helium case to house the ultraconductive cable is surrounded by a high-vacuum multilayer adiabatic space and a cylindrical shroud cooled with liquid nitrogen for secondary cooling, and around this again, by a high-vacuum adiabatic layer and outermost, a stainless steel sheath.

As a whole, the system has a concentrict triple-tube structure. The tubes are individually supported by teflon bars having low thermal conductivity. The bars are provided with wheels at their ends to allow for movement by thermal expansion and contraction on cooling in order to prevent excessive stress in the tubing.

Fig.1 shows a cross section of the cable system.

The current supply terminal to the ultraconductive cable is at the ambient temperature section and thermally connected to the very low-temperature section. In order to minimize thermal

ingress, one current lead only is used for each phase of an AC 3-phase system. Each lead is provided with a braid structure consisting of about twenty thousand 0.2mmϕ formal insulation wires, which are cooled with helium gas in the cable section.

The power supply has a capacity of 3-phase 200kVA AC or single-phase 750kVA AC, and a rated supply current of 3-pahse 10kA and permits a continuous single-phase 60kA supply.

The power supply is equipped with an induction voltage regulator to enable supply current to range from 0 to 10kA, simultaneously enabling current increase rates (A/sec) to be regulated.

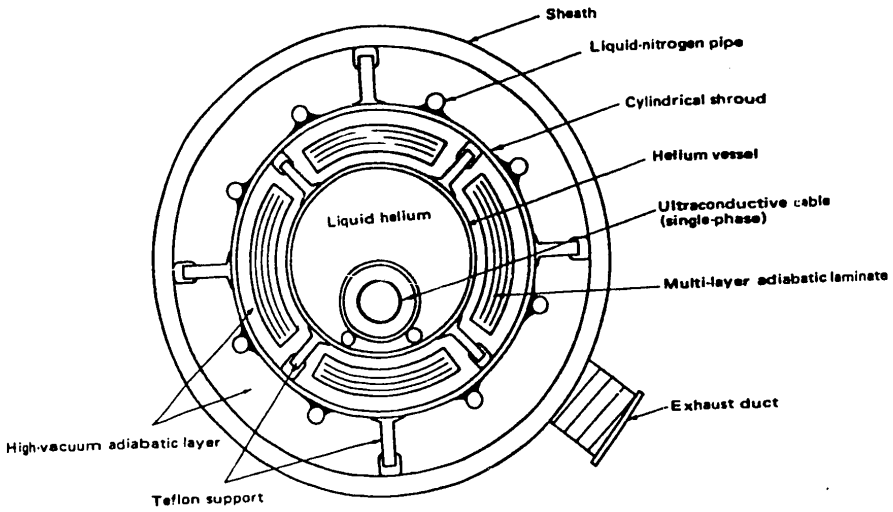

Fig. 1. Structure of Cross Section of Ultraconductive - Cable Test System

2. Ultraconductive Transmission Cable for Supply Tests

In its basic structure, the ultraconductive transmission cable for supply tests consists of a coaxial cylindrical cable using Nb_3Sn tape.

To give flexibility to the ultraconductive cable, the Nb_3Sn tape is wound on a flexible former with a suitable pitch without gaps to form a cylindrical conductor. This conductor is then wound with an electrical insulator (polyethylene synthetic paper) in adequate tension and uniform thickness and the product is further wound with Nb_3Sn tape uniformly without a gap to provide a shield conductor.

Since basic supply tests with a short model cable using Nb/Cu tape had proved that reduction of the axially directed magnetic field in the space in the cable to an adequate extent enables increase in AC loss to be prevented, the laboratory decided to apply a zero-axis magnetic field designing method, for the basic designing of the 10m ultraconductive cable, which uses the same winding pitch for the ultraconductive tape of both supply and shield conductors.

The Nb_3Sn tape used has a 3-film structure consisting of copper and stainless steel tapes and an Nb_3Sn film between them. For the supply conductor, the copper side was inside. For the shield conductor, the stainless steel was inside. This was to reduce eddy current losses in the ultraconductive tape and provide mechanical strength.

Photo 1 shows the Nb_3Sn tape used and its use in a part of the ultraconductive cable.

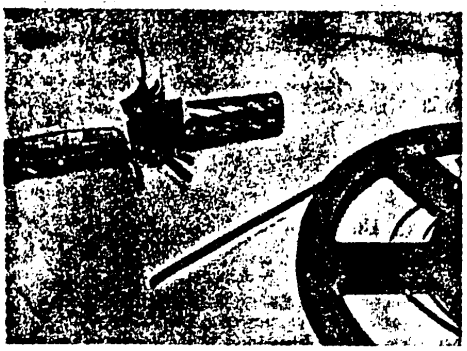

Photo 1. Nb_3Sn Tape and Ultraconductive Model Cable

3. Supply Tests and Future Plans

Tests are intended to prove that the 10m model cable is able to attain a maximum constant surface current density of over 1,000A/cm which was attained with the short cable and to accurately measure AC losses in cable sections for large power supply in order to review the ranges in which terminal effects can be neglected.

The preliminary test of the 10m long ultraconductive cable was successful and main tests are to start.

Future studies under consideration include the following: establishment of cable technology applicable with AC losses below the allowable level ($300\mu w/cm^2$) by carrying out supply tests with the 10m model cable of a variety of structures currently designed and establishment of cable technology with higher operating temperature by using new ultraconductors such as Nb_3Ge. Further a subsequent step is scheduled toward making ultraconductive transmission cables practical after proof studies of reliability for long-term operation using ultraconductive transmission prototype cables 100m long.

CSO: 4120

SCIENCE AND TECHNOLOGY

KILN FUEL CONVERSION TO COAL FINANCED BY JAPAN DEVELOPMENT BANK

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 56

[Text] • In order to reduce oil dependency of the domestic industries, the Ministry of International Trade and Industry started from this fiscal year, a financing system for alternative energy utilization promotion. The system, with ¥12.5 billion first fiscal year budget, is for (1) Facility investment required for fuel conversion from oil to coal, (2) Dedicated facilities for industrial LNG utilization, (3) Coal center construction costs etc. of the cost, 50% can be financed at an interest rate of 5.95%. This low interest rate was realized by combining the fund of Japan Development Bank with the no interest fund from the "Coal, Oil and Alternative Energy Special Account". The financing term is 15 years. The first financing of this fiscal year was awarded to three cement companies, namely Nippon Cement Co., Sumitomo Cement Co., and Onoda Cement Co., for cement kiln fuel conversion from oil to coal. MITI is requesting ¥47 billion for next fiscal year's budget for the system. The system will be expected to accelerate the reduction of oil dependency movement such as to LNG and coal utilization.

CSO: 4120

SCIENCE AND TECHNOLOGY

COAL ASH UTILIZATION DEVELOPMENT STARTING NEXT YEAR

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 56

[Text] * Environment Agency is checking in advance air contamination and waste material pollution effects caused by fuel conversion from oil to coal. Four research laboratories of the Agency of Industrial Science and Technology are going to develop coal ash utilization technology from next fiscal year. The research efforts are aimed at the "Investigation of Coal Ash Extraction Treatment Technology" and "Investigation of Utilization Technology by Coal Ash Solidification".

The former study is to develop an extraction treatment method to use coal ash discharged from coal burning power plants light weight building material. The coal ash which consists mainly of silicates with some heavy materials and impurities, is changed to treated ash whose composition is suitable as a light weight building material.

The solidification of the coal ash is to make a heavier building material by a molten solidification method. A key issue is to develop an energy saving type manufacturing method. Basic data will be accumulated in the four years till fiscal 1984 to develop the both technologies which can prevent from pollution caused by the coal ash.

CSO: 4120

SCIENCE AND TECHNOLOGY

EXPECTATIONS OF FLOWING FLOOR COAL COMBUSTION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 56

[Text] * Electric Power Development Company started construction of a test plant for flowing floor coal combustion in Wakamatsu thermal power plant with 150 thousand kW capacity. The test plant will be completed in March, 1981, followed by two and half year trials. Flowing floor combustion is drawing much attention as one of the technologies to expand coal use. Coal crushed into 10-15mm diameter is continuously loaded into a boiler, while air is blown from the lower part of the boiler. Thus, coal burns in a floating condition. Sulfur generated combines with lime which is introduced together with the coal. Desulfurization in the boiler eliminates the need for desulfurization facilities which current power plants have to install.

The boiler temperature is below 1,000°C namely, 200 to 600°C less than that of conventional coal burning boilers. The lower temperature contributes to reduce NOx emission. In addition to advantages for overcoming pollution problems, it is possible to burn low calory or various kinds of coal. The test plant has a 20 ton/hour steam generation capacity. The construction cost is ¥2.2 billion. Experiments such as combustion efficiency improvement will be conducted till September, 1983. The company plans to construct a demonstration plant with a 200 ton/h steam generation capacity to realize early practical application.

CSO: 4120

SCIENCE AND TECHNOLOGY

DEVELOPMENT OF LARGE CAPACITY CABLE FOR ONE MILLION KVA POWER TRANSMISSION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 56

[Text] * In order to accomodate the ever increasing power demands in Tokyo, the Tokyo Electric Power Company, Inc. has decided to develop in a 5 year program starting this year, a one million KVA class large capacity underground cable which is three times larger than current cable power transmission capacity. Two candidates for the underground cable are an "Internal Cooling Cable" and "Conduit-Gas Line Power Transmission for Long Distance". The company will invest ¥2 to 3 billion in total for this program to be completed by fiscal 1984. The newly developed cable will be used in areas with dense population. Currently, OF and POF cables are used as underground cables. Other makers will cooperate with the Tokyo Electric Power Company, Inc.

The "Internal Cooling Cable" has a cooling medium in the cable core, which absorbs heat generated by power transmission. Insulation oil, water and liquid Freon are among cold medium materials.

The "Conduit-Gas Line Power Transmission" uses a sealed aluminum pipe with a diameter of 35 to 70cm power transmission cable is located in the pipe which contains stable and harmless SF_6 with excellent insulation properties.

CSO: 4120

SCIENCE AND TECHNOLOGY

PRACTICAL LNG COLD HEAT POWER GENERATION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 56

[Text] • Tokyo Electric Power Company, Inc. has decided to construct a world first commercial LNG cold heat power plant with 20,000 to 30,000kW capacity at the under planning Tomitsu thermal power plant site in Chiba Prefecture. The company expects to start the plant operation in fiscal 1985. LNG cold heat utilization was added to the original plan of constructing a combined cycle power plant using LNG as fuel with 2 million kW capacity at the Tomitsu site. Location negotiation is being made haste to start construction this year.

The Tokyo Electric Power Company, Inc. succeeded in July 1979 LNG cold heat utilization power generation for the first time in the world with a test plant having 442kW capacity which combined the so called direct expansion method and secondary medium method. Two year experiments at the test plant at Sodegaura Power Plant are still going on till and of next year. The test results obtained so far provided the company firm comfirmation for a practical plant in all aspects, such as controllability, reliability and safety. Thus, the commercial plant was added to the Tomitsu power plant plan as it took shape. The construction cost is ¥300,000 to 400,000 per kW, which is rather expensive. The power generation cost is ¥10 to 15 per kWh.

CSO: 4120

SCIENCE AND TECHNOLOGY

ELECTRIC POWER FROM METHANE

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 57

[Text] *Hasshu Kosan Co. has developed a methane gas power generation system generating electricity using methane from pig excreta.*

The system consists of a methane gas generation tank, a desulfurization tank, a compressor, a storage tank and a generator. The gas generation tank is a sealed steel container coated on the inside with hard epoxy resin to prevent corrosion and coated outside with foamed styrol to provide insulation. The tank is divided into three sections for excreta entry, fermentation, and recovery of treated excreta and, has two agitation propellors.

The temperature inside the tank is maintained at 24 to 30°C. The excreta mixed with water at the ratio of 1:4 is introduced into the tank and agitated by the propellors under an oxygen deficiency condition.

Then, the excreta is transferred to the fermentation tub where it remains for 20 days. After complete fermentation, the excreta is then transferred to a water recovery chamber. The gas generated is stored in a storage chamber located at the upper part of the equipment. When the storage chamber pressure reaches 80mmHg, a specially designed compressor for methane is switched on to move the gas to the main storage tank. Since the gas includes incombustible gases, such as carbon dioxide and hydrogen sulfide, it is treated in the desulfurization tank located between the compressor and the storage tank. The desulfurization tank is filled with caustic soda, oxidized silver and charcoal for neutralization, desulfurization and absorption treatment for deodorization. The gas is then pressurized in the storage tank to 230 to 250mmHg to be supplied to the power generation system.

CSO: 4120

SCIENCE AND TECHNOLOGY

HEAT AMP SYSTEM, BASED ON WELL WATER, DEVELOPED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 57

[Text] *Sakaniwa Shokai Co. has developed an inexpensive energy saving type airconditioning system which they call the "Heat Amp System", based on the fact that water temperature in a well is almost constant around 13 to 16°C throughout the year.*

Heat exchange between water pumped from the well and a heat transfer medium (Freon 22) is used for heating. The temperature of the medium pressurized to 7 to 8kg/cm² is raised to 30°C by the 16°C well water. The Freon 22, after the exchange of heat, is then compressed to 25kg/cm² by a compressor to further raise the temperature to 50 to 100°C. Another heat exchanger is used for heat exchange between the hot medium and city water which is used for building heating. The system can raise the room temperature 20°C higher than outside air temperature.

Cooling is the opposite process. The low pressure (5 atoms) low temperature (33°C) freon returned from the condenser is boosted to constant pressure (25 atoms in average) by the compressor and the temperature is raised to 100°C in the process. Since the compressed heat medium is in a liquid phase, contact with the well water changes the medium into a gaseous phase by lowering the temperature to 32 to 33°C. Then, the freon gas is forced through an expansion valve and diffused to become cold medium, similar to absorption type chiller method. Finally, the cold heat is transferred to the building pipes for cooling. The system can maintain a room temperature 7°C lower than outside air temperature.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW ZIRCONIUM PROCESS FOR NUCLEAR FUEL CLADDING DEVELOPED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 58

[Text] • In producing zirconium used as fuel cladding for nucelar power reactors, a new, creative process has been developed. Mitsui & Co., Ltd. in cooperation with Ishizaka Kenkyusho Co. has perfected the method, which can yield high-quality zirconium at half the cost of existing producers, in addition to eliminating the needs for environmentally controversial solvents and acids, and other advantages.

The new process is referred to as a distillation method. It excels conventional extraction methods employing organic solvents by reducing the extraction process to only two stages, chloridization and distillation. This system is capable of reducing the price by half, to 3.3 dollars/lb. Present processes, in order to separate hafnium in the ore, first extract zirconium by chloridization with a large amount of organic solvents and acids, requiring additional complicated procedures such as precipitation and calcination.

The new method features: (1) simple preparation procedures with half the construction expenses, (2) a high-quality products yielded by distillation; (3) a pollution-free system which does not use solvents and acids; (4) separated hafnium useful for hard metals or control rods. The element is also promising as a titanium substitute because of its greatly reduced cost.

CSO: 4120

SCIENCE AND TECHNOLOGY

PNC TO START CONSTRUCTING PU FUEL PRODUCTION PLANT

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 58

[Text] * The Power Reactor and Nuclear Fuel Development Corporation (PNC) has revealed that it will commence construction in 1981 F.Y. of a fully automatic FBR plutonium fuel production plant reportedly the world's first, with a 5 tons/year capacity. The plant is to produce MOX fuels for the FBR prototype, "Monju" (electric output: 300MW), which will reach criticality in 1987. Expected to initiate full-fledged operation in 1986, the facility is designed to secure lowered radiation exposure to operators as well as labor saving and cost reduction. At the same time, it not only produces prototype reactor fuels but is characterized as a precursor plant for future practical reactor fuels. In Japan plutonium for FBRs is obtained by reprocessing spent nuclear fuels of light-water reactors (LWR); since the product thus extracted is strongly radioactive level plutonium, remote-controlled operation is indispensible in avoiding excessive doses.

By contrast, European nations treat spent fuels from gas reactor to provide raw plutonium which has less intense radioactivity than that of the LWR's, so that FBR fuel manufacturing factories, they maintain, can be dependent upon manual operation.

However, LWR-made plutonium will also have to be used even in Europe in the near future, so the entirely-automated fabrication plant which the PNC is now about to build is understandably attracting great interest.

CSO: 4120

SCIENCE AND TECHNOLOGY

EXPERIMENTAL MULTI-PURPOSE HTGR TO ATTAIN CRITICALITY IN 1987

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 58

[Text] * The Japan Atomic Energy Research Institute (JAERI), in an effort to establish a public-private setup for developing a multi-purpose, high-temperature gas reactor, has ordered the detailed designing for the experimental reactor (thermal output: 50,000kW) which they hope will reach criticality in fiscal 1987, from the four nuclear industry groups consisting of Fuji Electric, Hitachi, Mitsubishi Heavy Industries and the Nippon Atomic Industry Group, designating Fuji Electric as a representative.

The multi-purpose HTGR is said to be the last resort in order to shift the non-electric power sector, which consumes more than two-thirds of the primary energy supply, from petroleum to nuclear heat. Consequently, the Science and Technology Agency, in light of national security, hereafter will work vigorously at allocating an increased R&D budget for the JAERI, in order to achieve immediate realization.

When it receives these resources the JAERI will tackle the detailed design task in the 3-year project at a total cost of about ¥4 billion, the construction of the reactor will begin in mid-1983 F.Y., eventually spending as much as ¥150 billion, with criticality expected in 1987.

CSO: 4120

SCIENCE AND TECHNOLOGY

ADOPTION OF AET'S MODIFIED BWR TO KARIWA NUCLEAR PLANT

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 58

[Text] * The Advanced Engineering Team (AET) formed by G.E. (U.S.) and other five BWR manufacturers is developing an improved BWR which Tokyo Electric Power Co. is considering introducing into the Kariwa nuclear power station. Unit 3 reactor (1100MW) in Kashiwazaki, scheduled for start-up around 1990. The modified-type reactor has allegedly undergone the following drastic design changes in contrast to existing models: (1). a circulation pump built in the reactor container; (2). load-follow operation is possible; (3). easier routine inspection has been provided for. At present, commercialization efforts are being made.

AET is an organ of international cooperation launched by five BWR makers of G.E., Hitachi, Toshiba, Asea Atom (Sweden), Ansaldo Meccanico-Nuclear SpA (Italy). The modified reactor features substantial improvements, such as lower exposure doses and easier operation, over conventional types. Moreover, it is said to have incorporated the results of reactor modification & standardization research now being carried on by the MITI, thereby being tailored to the needs of the Japanese industry.

CSO: 4120

SCIENCE AND TECHNOLOGY

STEEL THAT DAMPENS VIBRATION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 61

[Text] *A new vibration damping steel having excellent vibration and sound absorbing properties TRANQALOY has been developed.*

Metallic sounds produced when metal items are struck are harsh to the ear, detrimental to the living and working environment, and vibration contributes to shortening the functional life by fatigue, of materials used for machine components and reducing the accuracy of precision machines. Thus, conventionally, such methods have been used as increasing the size of components that are vibration sources and covering components that are subjected to vibration with a soft or elastic substance such as rubber. These methods, however, have the demerits of increased weights, increased costs and restrictions on use. So, it has been desired to develop metallic materials which themselves absorb vibration.

The new vibration damping steel has been made by adding some alloying elements to 12% chrome steel as its base, and applying heat treatment at the high temperature of 1,000°C. The resulting material is then able to convert external sound and vibration into thermal energy by the movement of magnetic domain wall which exist in the steel.

The new steel is comparable in vibration damping characteristics with conventional ferrous and non-ferrous vibrating damping materials and also has the following features: 1) Because it is heat treated, it has excellent mechanical properties such as tensile strength and fatigue strength. 2) Because it is a low-carbon steel, it can be casehardened by carburization and nitrization and thus, can be used effectively for components which require resistance to wear. Therefore, it is expected to find wide application as a material for components of audio products, automobiles, office equipment and electrical appliances.

CSO: 4120

SCIENCE AND TECHNOLOGY

ENTIRE PROCESSES OF SEAMLESS PIPE MANUFACTURE FULLY AUTOMATED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 61

[Text] *Kawasaki Steel Corp. has made practical computer control of all mills at its medium-diameter seamless pipe factory, while developing a hot-thickness gauge for pipes.*

Different from sheet rolling, the rolling of seamless pipes consists of 3-dimensional complicated plastic machining in several mills and this has delayed application of process computers. The company has recently succeeded in direct computer control of all the mills in their entire factory by 1) developing and making practical tracking systems for individual materials in all the process in the factory, 2) developing and making practical on-line sensors, 3) developing a new mill controlling model, 4) developing an automatic operation system and an energy saving control model for heating furnaces, and 5) organizing a total system integrated with the production control system.

The new control model has brought wall thicknesses, outer diameters, roundness and lengths of final products close to requirements and also has raised the yield from 92% to 95%. Furthermore, full automation by controlling furnace heating achieves an approximate 10% saving of energy consumption.

On the other hand, the company has been engaged in developing new on-line sensors with the view to improving medium-diameter mills and has now developed a hot-thickness gauge in cooperation with Fuji Electric Co.

CSO: 4120

SCIENCE AND TECHNOLOGY

TECHNOLOGY FOR MANUFACTURING NON-FERROMAGNETIC INVAR ALLOY

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 63

[Text] *Technology for manufacturing Invar alloys which deform little in magnetic fields.*

Invar alloys have small coefficients of thermal expansion and are widely used in precision machines, primary standards for weights and measures and elements in bimetal devices. However, they are ferromagnetic ion-nickel alloys. In magnetic fields, they tend to elongate by the effect of magnetism, while disturbing the magnetic fields. Thus, they can hardly be used in magnetic fields.

New technology recently developed is for manufacturing an alloy (chrome Invar alloy), which is non-ferromagnetic and has a very little coefficient of thermal expansion at room temperature, made by adding iron (about 4%) and manganese (about 1%) to pure chrome (about 95%). The various stages of manufacture are outlined below.

1) Melting

Raw materials: chrome, iron, manganese and rare earth elements as additives, are melted for refining by induction heating in an inert atmosphere. The molten stock is cast in molds which are contaimination free and is then annealed together with the molds in a high-temperature heating furnace.

2) Hot Machining

The ingot obtained in process 1. is then hot extruded for dividing purpose and is cleared surface oxides by cutting. Then, it is reheated to high temperature and is put to secondary extrusion.

3) Post-Treatment

The extruded ingot is annealed, cut into shapes appropriate, machined and ground in preparation as a base material for final products.

The conventional 36% nickel Invar alloy shows an elongation factor of 20 x 10^{-6} in a magnetic field of 70 oersted, while the chrome Invar alloy has a minimal deflection factor of less than 1 x 10^{-6} even in a magnetic field of 200 oersted. The only disadvantage of this alloy is its high price. So, efforts will be necessary to reduce prices by developing markets and expanding production.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW GASEOUS NITRIDING METHOD DESCRIBED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 63

[Text] *"Bettemiding method", a new method of gaseous nitriding with the ε layer formed below 10μ of the outermost surface of steel has been developed.*

Because it involves little deformation while providing a hard nitrided layer, gaseous nitriding has been made practical as a case hardening heat treatment for steel and has been applied to important parts which require resistance to wear and fatigue, and strength at high temperatures.

However, gaseous nitriding causes active nitrogen to penetrate by diffusion into the surface of steel to form a nitrided layer. This layer contains nitrogen with increasingly density near the surface and has an ε layer several μ to several ten μ at the outermost surface. This ε layer, though highly resistant to corrosion, is brittle and not hard. If it is thicker than 10μ, it can become loose.

Those parts which require high accuracy, such as spindles for machine tools, are ground to attain accuracy after nitriding and at the same time are cleared of the ε layer. Thus, there is no problem about them. On the other hand, parts which are treated only by buffing such as screws for forming plastics are not completely freed of the ε layer. Thus, in service, this can cuase trouble caused by the ε layer coming loose.

The "Betterniding method" is a method which provides an ε layer less than 10μ thick and more tenacious than nitrided layers formed by conventional nitriding.

This method enables the depth of nitriding to be adjusted by controlling processing time and thus, enables thinner ε layers to be obtained.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW MANUFACTURING METHOD FOR ZIRCONIUM

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 63

[Text] *A new method of manufacturing zirconium, "distillation with differential partial condensation" has been developed.*

Zirconium is essential as a covering material for fuel elements used in nuclear power generation because it does not absorb neutrons, provides mechanical strength, and is resistant to corrosion. Conventionally, however, it has been difficult to technically separate hafnium which absorbs neutrons and which is found together in the same and therefore, the manufacture of zirconium has been expensive.

Conventional manufacture of zirconium first extracts chloride stock using a large quantity of organic solvents and acid, and processes it for sedimentation and roasting, and further for secondary chlorination and sublimation. In contrast, the new process only chlorinates and distills the stock . Thus, the cost is around half that of conventional manufacture.

The new process has an additional merit of easily obtaining high purity hafnium from hafnium chloride separated by using the same distillation method.

CSO: 4120

SCIENCE AND TECHNOLOGY

ORDERS RECEIVED, PRODUCTION OF INDUSTRIAL ROBOTS IN 1979

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 64

[Text] • The Japan Industrial Robot Association has published results of a "1979 survey of industrial robots". The survey covers 176 makers.

The results of the survey, while shown numerically in the Table below, disclose the following:

(1) Orders received, production, and shipment of industrial robots in terms of money all show very high growth (orders received indicating an 88.3% increase, production a 51% increase and shipments a 34.8% increase over the previous year).

(2) In terms of models, advanced types, such as playback robots having memorizing and reproducing functions, and numerically controlled robots enjoy a good demand together with stationary and variable sequence robots for simple work.

(3) In terms of demand by industry, the following three account for about 60% of total robots shipped: automobile (about ¥14.4 billion), synthetic resin processing (about ¥6.5 billion) and electric equipment (about ¥4.7 billion).

(4) The total number of robots shipped amounted to 56,900 as of the end of 1979.

Table 1. 1979 Sales of Industrial Robots and Applied Systems (in ¥0.1 billion)

Robot type	Orders received	Production	Shipments
Stationary sequence robot	268 (121)	222 (131)	98
Payback robot	77 (41)	67 (44)	–
Intelligent robot	30 (28)	17 (2.7)	–
for industrial robot	523 (278)	443 (293)	402 (298)

Note: Figures in the parentheses denote data for 1978.

CSO: 4120

SCIENCE AND TECHNOLOGY

DEMAND SOARING FOR ULTRA-PURE-WATER PRODUCTION PLANTS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 64

[Text] * Demands for ultra-pure-water production plants for the electronics and pharmaceutical industries have recently been increasing, encouraging makers of water disposal equipment and inverse-osmosis membranes to increase production by enlarging their relevant divisions.

In Japan, no ultra-pure-water systems had been available until just a few years ago, when Nomura Micro-Science, Kurita Water Industries and Japan Organo successively advanced into this field. Industrial sources estimate that there is a demand for ultra-pure-water production systems for about 10,000t of water both in the electronics industry and in the pharmaceutical industry. However, at the beginning of the ultra-LSI age, the manufacture of semiconductors and integrated circuits is likely to increase rapidly. Thus, demand for ultra-pure-water production systems is expected to increase rapidly.

Under these circumstances, Nomura Micro-Science, which has been importing and marketing ultra-pure-water systems, has now started to manufacture ultra-pure-water systems by establishing a joint venture company "Japan Aqua Media" in partnership with JGC Corp. and US Aqua Media Co. On the ohter hand, a pioneer Kurita Water Industries is planning to build up production on the basis of its past supply to the electronics industry. Other makers of water disposal equipment including Japan Organo which manufacture pure-water plants are also building up production in preparation for receiving orders for ultra-pure-water systems from the electronics industry.

As for inverse osmosis membranes necessary for ultra-pure-water systems, fiber makers such as Toray and Toyobo have successively started manufacturing such membranes domestically. Thus, sufficient supply of systems for inverse osmosis membranes to meet the increasing demands for ultra-pure-water systems are established.

CSO: 4120

SCIENCE AND TECHNOLOGY

HIGH-TEMPERATURE (300°C) SUPERSONIC FLOW METER

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 65

[Text] *In cooperation with the Power Reactor and Nuclear Fuel Development Corporation, Fuji Electric Co. has developed an entirely new high-temperature supersonic flow meter which is capable of measuring with high accuracy, flow rates of liquids in the high temperature range up to 300°C.*

The principle of the supersonic flow meter is as follows and has been applied widely: Two supersonic transducers (transceivers) are mounted on the walls of a pipe, as shown in Fig.1, and supersonic waves are transmitted between them, or at an angle to the flow of liquid. There exists a time lag in the propagation between the waves which travel against the flow of the liquid and the waves which travel in a reverse direction. The time lag is proportional to the flow rate.

Because of the nature of their materials, however, conventional supersonic transducers are available only in the temperature range of 0°C–40°C with none of them being sufficiently strong to withstand higher temperatures. The new flow meter recently developed has transducers made of entirely different materials, and thus successfully providing sufficient thermal resistance.

Fig.2 shows the structure of the new transducer. Its element is made of lithium niobate which has as high a Curie point of 1,200°C instead of that for conventional plumbum zircon-titanate (PZT), the wedge made of stainless steel and nickel instead of resin and the sound coupler made of metal foils and high-temperature solder instead of resin and grease.

With a view to applying this new flow meter to the inlet pipe (5cm in diameter) of the primary circulation system of "Fugen", a newly constructed converter, the Corporation has conducted a flow rate measurement test over a wide temperature range from room temperature to 285°C, proving that variations in sound speed due to temperature can be corrected with an accuracy of ±3%.

CSO: 4120

SCIENCE AND TECHNOLOGY

LASER MACHINING MACHINE DESCRIBED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 66

[Text] Mitsubishi Electric Co. has developed and begun marketing their MEL Laser 1000 type CO_2 gas laser machining machine.

The machine consists of a 1kW CO_2 gas laser oscillator and a CNC work table which is controlled simultaneously on two axes.

Laser machining has features as follows, (1) noiseless, (2) without cutting loss, (3) the heating point and amount can be precisely controlled. And, as has been forcast, conventional machining will be replaced by laser machining as one of the advanced machining methods.

The CO_2 gas laser oscillator is of a compact design and highly output of 1kW with a resonance length of 1.5m, due to its 10 times higher gas pressure than a conventional lasers. And because of the maintnance free design, improved stability against temperature variation and improved optical system design, the equipment is easily applied to production lines.

Main Specifications:

Rated output of the oscillator	
single-mode	550w
multi-mode	1,000w
Output stability	±8% (8 hours)
Travel of the working table	500 x 500 mm
Feed	0 ~ 8 m/min
Positioning accuracy	±0.03 mm

CSO: 4120

SCIENCE AND TECHNOLOGY

LARGE MACHINE TOOL PRODUCTION

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 66

[Text] Since last year, Japanese machine tool demands have sharply increased due to active equipment investment by domestic and foreign automobile makers, and it is considered that orders received from automobile makers have reached their peak amount and will full sharply in 2 ~ 3 years, after which orders for large machine tools from the aircraft, ship building, nuclear and heavy electric machinery industries are expected increase as they replace their equipment.

According to the announcement of the Japanese Machine Tool Builders Association, received orders of 68 major member companies in the first half of 1980 showed that with respect to type of industry, the first largest amount of orders is ¥91,000 million (39% over the same period of previous year) from the general machine manufacturing industry, the second position is ¥73,300 million (13.2% over of the same period of the previous year) from the automobile industry, but those in consumer electrical products, computers and electrical products ordered ¥11,800 million (11% over), ship building and transportation machinery ordered only ¥6,300 million and heavy electric machinery placed orders for very little.

However, it is expected that equipment investment from some industries including the U.S.' iron and steel industry, which has not replaced any equipment in several years, will sharply increase. In Japan, Shin Nippon Koki Co., Toshiba Machine Co. and Hitachi Seiki Co. plan production increases for large machine tools.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW MILLING MACHINE MAKER

Tokyo TECHNOCRAT in English Vol 13, No 11, Nov 80 p 66

[Text] Takisawa Machine Tool Co. has decided to enter the milling-machine field on a full scale basis.

The company is one of the leading makers of NC lathes and has sales of ¥9,500 million this year. Takisawa Sangyo Co., a group member of the company, is one of the leading conventional lathe makers and has sales of ¥4,000 million in this year.

Entering the milling machine field, the company aims at being an all around machine tool maker and has established a new company, Takisawa Kikai Co., for milling machine production.

The new company has developed and begun the marketing their "Mill Power-MP-VII" type precision ram type turret milling machine for machining metal dies, jigs and fixtures.

The new company has a plan for the eventual development of a large milling machine and an NC milling machine.

CSO: 4120

SCIENCE AND TECHNOLOGY

JAPANESE MACHINE TOOL EXPORTS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 66

[Text] Since 1974, Japanese machine tool exports have increased on a full scale and in 1979, exports reached ¥206,600 million (27% over the previous year).

More favorable conditions are continuing in 1980, and business result for the first half (January - June) marked ¥126,000 million (42% over the same period of the previous year).

Formerly, Japanese machine tool users were mainly subcontract factories, such as jobbing shops in the U.S., but recently, the most received orders are from leading makers of automobiles, aircraft and electronics in the U.S. and Europe due to the higher technical level of Japanese machine tools.

Automobile makers in the U.S. have come to understand that the stronger competitive force of Japanese compact cars comes from the superior machine tools made in Japan and have decided to plase large orders for Japanese machine tools.

Already, Japanese transfer production lines made by Toyama Machine Works Ltd. are operating in Sharonville plant (OHIO) of the Ford Motor Co.

The U.S. aircraft industry (Lockeed and Boeing) has begun ordering Japanese machine tools for large aircraft production for the services.

According to investigations by the American Machinist, the ranking of machine tool production in 1979, for Japanese machine tools, with a share of 11.9% was fourth in the world behind West Germany (18.0%), the U.S. (17.1%) and U.S.S.R. (12.7%) but from the ranking of exports, Japan was the second (11.9%) behind West Germany (26.4%).

CSO: 4120

SCIENCE AND TECHNOLOGY

INITIAL TEST OF AIRBORNE PULVERIZED COAL TRANSPORTATION PROVES SUCCESSFUL

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 68

[Text] • The Coal Mining Research Center, has succeeded in its initial test of airborne transportation of pulverized coal and has decided to start more serious tests next year.

Demand for coal is expected to increase rapidly as one alternate energy source to oil. The most important point here, in connection with environmental measures, is how to transport coal efficiently. One solution to this is the airborne transportation of pulverized coal (transportation of pulverized coal using as a medium, a high-speed jet stream of an inert gas).

The latest test has proven the following: 1) It is necessary to keep air speed constant in the transport duct, which must have a larger diameter at the outlet than at the inlet. 2) If coal particles are small, no bottom flow is caused in the duct and therefore, the duct is unlikely to become choked. 3) Over long-distances, transport pressure can be controlled within certain limits by reducing the ratio of pulverized coal to air. 4) Hazards, such as explosions, can be avoided by using an inert gas, such as nitrogen as the transport medium, to reduce the concentration of oxygen to 10–15%. 5) Wear of pipes and power costs hardly present any problems.

CSO: 4120

SCIENCE AND TECHNOLOGY

AUTOMOBILE INDUSTRY CONTINUES LARGE-SCALE INVESTMENTS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 68

[Text] • The automobile industry of Japan is planning to continue for some years further investments in facilities, at the same high level as in the past. Toyota Motor Co., Ltd. has budgeted for the huge sum of ¥240 billion for the term starting June next year, indicating a 60% increase over that for the same period previously. Nissan Motor Co., Ltd. has also planned the large investment of ¥150 billion for the term beginning March next year, indicating a 25% raise over the same period previously. Also, Toyo Kōgyo Co., Ltd., Mitsubishi Motors Corp., Honda Motor Co., Ltd. are continuing to carry out investments in facilities at previous high levels.

Reportedly, most investment is being applied to research and development of low-fuel-consumption front-drive type small vehicles with scarcely any investment being used to increase production.

On the other hand, it is reported that the big three makers of the U.S. are planning to make gigantic investments in facilities, amounting to $80 billion (about ¥1.75 trillion) over 5 years till 1985. All this suggests that investments in both Rand D. and facilities by automobile industries worldwide, are likely to be on an unprecedented scale.

CSO: 4120

SCIENCE AND TECHNOLOGY

CONTROL SYSTEM FOR 3-DIMENSIONALLY AUTOMATIC WAREHOUSING BEING STANDARDIZED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 68

[Text] • Daifuku Machinery Works, Ltd. has recently standardized a computered control system for 3-dimensional automatic warehouses and has started to develop a market for the system.

The warehouses are provided inside with shelves arranged to make many-storied storage compartments and are so designed to allow palleted goods to be stored or taken out as necessary using stacker cranes, conveyors or lifts. Because they have the advantage of enabling maximum use to be made of limited, permitting easy inventory control and contributing to labor saving, recently they have started to become rather popular.

The automatic warehousing industry has grown to account for about 10% of the goods distribution equipment market, which is said to amount to about ¥400 billion, its main products being computer controlled 3-dimensional automatic warehouses.

The system newly developed by Daifuku Machinery Works incorporates a 16-bit microcomputer as the internal memory and has a combined display unit and printer. (The tradename is "LN-1000".)

The standard price for the basic unit (including hardware and software) of "LM-1000" is ¥20 million, which is about half that for types with comparable functions produced to order.

CSO: 4120

SCIENCE AND TECHNOLOGY

RESEARCH OF BACTERIAL TECHNOLOGY

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 82

[Text] * The Science & Technology Agency will initiate a research project involving technology for utilizing bacteria. Beginning in fiscal 1980, this is the sixth subject to be included in the agency's life science research program.

The agency set-up a life science promotion center in fiscal 1977 to launch a 10 year program. Five projects have been started since, including these related to aging control, bio-reacter, and artificial organs. The new project is aimed at improving the functions of useful bacteria and thereby facilitating the production of useful materials that cannot be easily formed through chemical reactions. A total of ¥800 million will be spent on research work in the period up to 1986. Research will be carried out in three main fields; methods for improving bacteria strains including gene manipulation, synthesis of useful materials, and industrial applications of bacterial culture.

Objects of synthesis include hormones, interferon and anti cancer agents. The bacterial method, combined with the DNA recombinant technique is expected to be used in a wide range of fields.

CSO: 4120

SCIENCE AND TECHNOLOGY

COMPUTERED TRAIN OPERATION CONTROL SYSTEM

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 68

[Text] * Nankai Electric Railway Co. has recently completed PTC, a train operation control system using a computer. PTC (programmed traffic control system) has been under development since 1976 at a cost of about ¥2.2 billion to serve lines in total 79km including the Nankai Line (between Nanba and Wakayama).

PTC is designed to control automatically signals and rail switches at stations, as well as destination display guides. Train route schedule from the first through to the last train are stored in the computer at the central control office installed at Nanba Station. Data is transmitted to the central office via the CTC (central train control), transmission system, from stations, advising locations of trains and conditions of signals, and is input in the computer.

The computer outputs necessary control commands, such as guide displays, and the commands are transmitted to local linkage systems via the CTC transmission system.

The CTC adopted by the company, has all important systems duplicated to achieve reliability and uses microwave circuits which connect the center with local stations for CTC transmissions. This enables the locations of trains to be displayed on the displayboard by using only CTC transmissions if the computer fails and also enables guide control data at stations to be output.

CSO: 4120

SCIENCE AND TECHNOLOGY

HYDRAULIC CAPSULE PIPELINE TRANSPORT SYSTEM MADE PRACTICAL

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 69

[Text] *Hitachi Shipbuilding & Engineering Co. have found a way to make practical a hydraulic capsule pipeline transport system as a new means of transporting materials. The system is attracting much attention and they have decided to accept orders for it.*

The transport system is designed to make use of the force of the water flow in the pipeline to transport materials contained in capsules. Pneumatic capsule pipeline transport systems which use air as the dirivng medium have already been made practical to some extent. Hydraulic systems, on the other hand, are still in the research and development stage at home and abroad, while hydraulic systems have such disadvantages as 1) low transport speed (around 1.5m per sec.), about 1/5-1/10 times that of pneumatic systems, and 2) the necessity of taking measures for preventing dry goods from becoming wet, they have such advantages as 1) capability of transporting heavy goods over long distances, which is infeasible by pneumatic systems, 2) require pumping power as small as about 1/3 of the requirements for pneumatic systems and 3) generate almost no noise compared with pneumatic systems. Thus, they are attracting worldwide attention as new future transport systems.

Hitachi Shipbuilding & Engineering has conducted a series of tests, installing a loop pilot test plant with a pipe 30cm in inner diameter and 200m long and using 10 capsules. From test results, the company has judged that hydraulic systems can be made sufficiently practical. With a setup, for example, consisting of a pipeline 1.2m in inner diameter and 10km long and trains of 6 capsules running at a speed of 1.5m per sec. and at intervals of 84 sec., a test has proved that the system is able to transport 300,000m^3 of earth and sand per month, consuming a pumping power of 1,080kW (about 1/3 of the requirements by a pneumatic system in the same application).

CSO: 4120

SCIENCE AND TECHNOLOGY

LASER TYPE COLLISION ALARM DEVELOPED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 69

[Text] *Nagoya Electric Industries have developed a vehicle collision alarm which measures the distance between running vehicles with the aid of a laser beam and gives an alarm when the distance falls below a predetermined requirement.*

The collision alarm emits a pulse type laser beam and computes the distance to the vehicle in front by measuring the time for the laser beam to make a round trip back to its source. The alarm section is designed to compare the measured distance with a predetermined distance and if the former is exceeded by the latter, then sound a buzzer.

The laser used is a semiconductor type which emits a pulse beam with a wavelength of 0.905μ and a time width of 1μs at the peak output of 10W. It emits light about 1000 times per sec. to measure distances. The beam emitted has in front an expansion about 30cm in diameter. The reflection is condensed by a Fresnel lens because it is weak. Measurement covers distances up to 40m with errors within 2m.

CSO: 4120

SCIENCE AND TECHNOLOGY

LARGE ENERGY SAVING ATTAINED FOR MEDIUM-SPEED SHIP DIESEL ENGINES

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 69

[Text] *Nippon Kokan K.K. has attained a reduction of 6.5g per horsepower per hour in fuel consumption of a medium-speed ship diesel engine "16PC2-5V" having a maximum continuous output of 10,400 horsepower, compared with conventional engines.*

Recently, the company has conducted a full scale on-land test at its Tsurumi Manufacturing Works and has attained large energy saving compared with conventional engines of the same model, recording 138g per hour per horsepower of fuel consumption at 85% normal output.

To achieve this large energy saving, the engine has been modified by improving the exhaust ducts for discharging exhaust gases from the cylinders, increasing fuel injection rates by increasing the aperture diameter of the fuel pump and adjusting the timing of the gas supply and exhaust valves. The engine will be mounted on a 30,000t bulk carrier which is under construction by the company for Liberia.

CSO: 4120

SCIENCE AND TECHNOLOGY

SUPER-SENSITIVE GAS DETECTION, REMOVAL SYSTEMS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 70

[Text] * Seitetsu Kagaku Co. has developed a detection and alarm system and a removal system for very poisonous arsine and phosphine, which are material gases used in the manufacture of semiconductors.

The system developed by the company is based on the principles of flame photometry as its means of analysis. The system has the features: 1) high response because it detects within a minute, and 2) high detection level; it detects arsine at 0.004ppm (min.) compared with the allowable density of 0.05ppm. The system is priced at ¥7.5 million.

The removal system, on the other hand, is designed to remove the above gases discharged from ion injectors, etc. in semiconductor manufacture by causing them to be absorbed in a potassium permanganate solution while placing them in contact with the solution. The company's system is able to reduce these gases of an inlet density of up to 2% down to 0.5ppm and has such features as 1) a wide range of density of gases to be processed; 2) low replacement frequency for the changing liquids used for gas removal; and 3) high efficiency in arresting chemical and metal dusts contained in the exhausts from ion injectors, etc. The standard system having a processing capacity of 200m^3 per hour is priced at ¥20 million.

CSO: 4120

SCIENCE AND TECHNOLOGY

ION BEAM SYSTEM FOR MANUFACTURING ULTRA LSI

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 71

[Text] *The Institute of Physical and Chemical Research is planning to promote manufacture of ultra LSI elements by using a "super-fine high-brilliance ion beam system" which draws directly circuit patterns with the help of ion beam projection instead of using mask patterns. This method requires simpler processes than conventional mask pattern manufacturing using electron beam projection. The whole manufacturing system can be automated and the line width of circuit patterns can be reduced to super-fine 0.04μm, finer than by the conventional methods by a factor of 100.*

The institute intends to develop a super-fine high-brilliance ion beam system in two years from 1981 to 1982, and subsequently develop techniques for ionizing arsenic, boron and silicon, as well as materials for semiconductors and ion sources for injection and processing.

The ion beam system is expected to be designed as shown in the Figure. The key point of development will probably be electronic lenses to restrict and scan ion beams.

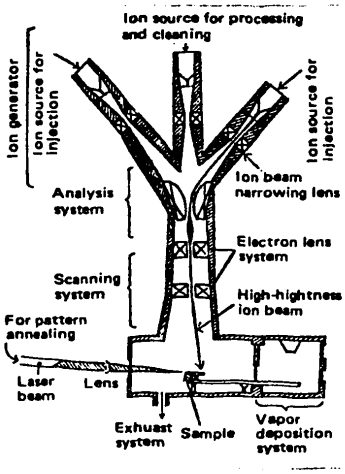

Fig. 1. Super-Fine High-Brilliance Ion Beam System to Be Developed by the Institute

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW MARK DETECTOR FOR ELECTRON BEAM EXPOSURE

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 71

[Text] *The Fujitsu Laboratories Ltd. has developed a new mark detector for electron beam exposure which is able to locate marks on IC and LSI chips at the high speed of 10 times the conventional level.*

The detector is designed as shown in the Figure. It works on the following principles. That surface which faces the wafer of a light guide (consisting of an aluminum case filled with glass or transparent plastic) provided in an electron beam passage is coated with a plastic scintillator to convert reflected electrons from the wafer into light with the aid of the scintillator. The light thus obtained is then led by the light guide to a photo-cell and is again photo-electrically converted into electric signals.

Scanning the wafer with a narrowed electron-beam causes electrons to reflect. The smoother the wafer, the greater the level of electronic reflection. Entering into fine slits, electrons have difficulty to exit. Thus, the presence of fine slits, etc. will reduce reflection. That is to say, that the level of electronic reflection from marks on wafers is lower than that from a blank wafer surface. Receiving low-level reflection, the scintillator emits weaker light. From these variations, marks can be located.

The Laboratories explains that it takes only 0.3–0.4 sec. to calculate and determine disorders portions by scanning marks in the four corners of chips vertically and horizontally in total 8 times.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW EMERGENCY BROADCASTING SYSTEM

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 72

[Text] * Toa Tokusyu Denki Co. has placed on the market an emergency broadcasting system equipped with a speech synthesizer, which allows individual loud speakers to continue operation even if the emergency braodcasting circuits are interrupted by accidents or damage such as by fire or an explosion.

The conventional emergency broadcasting systems use a method of transmitting sound signals from a monitor center to speakers installed at key points. Should the monitor center be damaged, the system loses its function and should circuits be damaged, broadcasting causes. In contrast, the new type installs at key points, independent loud speakers which are integrated with sound synthesizers memorizing words to be announced in emergency and have their own batteries as emergency power supplies. The speakers are connected to a monitoring center in the loop with a coaxial cable. Under this method, the monitoring center gives emergency instructions to be announced in accordance with accidents, etc., to individual loud speakers. This causes the loud speakers to start operation broadcasting instructions.

The system is also able to transmit announcements in a digitalized form from the monitoring center and able to use circuits in common with systems for detecting fire and gas leakage.

CSO: 4120

SCIENCE AND TECHNOLOGY

DETECTING OPTICAL-FIBER FAULTS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 73

[Text] *Prof. Okoshi et al at the Engineering Department of Tokyo University, with the cooperation of Furukawa Electric Co., have developed technology for detecting with high accuracy, faults in optical-fiber lines.*

Practical use of optical communication systems is near at hand, and when this takes place, techniques for detecting and locating faults (cracks and fractures) in optical fibers will become important at inspection time when photo-fiber cables are installed and in regular maintenance. Conventionally, the method of detecting an open circuit in copper wire has been to use a pulse echo method which sends a pulse wave and then locate the fault from the echo received.

With optical fibers, however, a pulse reflection from a broken face is very weak (about 4% of the pulse input) as most reflection disperses externally. Thus, the use of the pulse echo method requires detection techniques of much higher sensitivity.

Prof. Okoshi et al have resolved this problem by using a pulse which has a coded structure called an M series. The use of this coded pulse of a special waveform enables feable reflections which are very likely to be lost in noise, to be detected. Also, the measurement at the transmission end of the lag between the phases of the incident and the reflected pulses enables the point of troubled to be located accurately. Even if two or more more points are located closely, they can be detected separately.

The detection system consists mainly of an M series generator, a semiconductor laser, a variable delay circuit and a phase lag meter.

Tests have proved that measurement accuracy is ±20cm and that faults can be detected separately if they are more than 1m apart. Prof. Okochi and his cooperators are aiming at higher sensitivity and higher accuracy.

CSO: 4120

SCIENCE AND TECHNOLOGY

POCKET-SIZE LIQUID-CRYSTAL TV

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 73

[Text] *A number of companies are eagerly developing pocket-size or flat television sets. Toshiba Corp. has recently developed a liquid-crystal miniature television (monochrome) set. It is 17cmx8cmx1.5cm (with a screen: 3cmx4cm).*

In the development of thin miniature television sets, companies are promoting studies primarily on display methods using liquid crystals and light-emitting diodes as alternative to CRT's which are bulky. Toshiba has selected liquid crystal system. In general, however, the liquid crystal system has drawbacks of low response speed and difficulty in attaining adequate black-white contrast ratios.

Toshiba has eliminated these drawbacks by using a method of driving liquid crystal with a MOS array IC board. In other words, Toshiba has achieved high responsivity (30msec.) comparable with that of conventional television by developing a large IC which assigns switching elements and condensers individually to 220x240 picture elements and controlling condenser voltage. Also, the company has developed a new low-viscosity liquid crystal material and has established processing technology for finishing reflection surfaces nearly to a mirror finish, enabling a contrast ratio of "1:20" to be obtained. Also, for intermediate tones, it has established control techniques using condenser voltage.

For the time of being placed on the market and price, the company explains that a new television set will be sold for less than ¥100,000 in less than 2 years.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW METHOD OF TCNQ SYNTHESIS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 78

[Text] • Fuso Chemical Co. has developed a new method of tetracyanoquinonedimethane (TCNQ) synthesis which is being watched with keen interest all over the world, since it is an electron down for the charge-transfer complex in the field of organic electroconductive materials. The capacity of a pilot plant has been increased at Fuso Chemical's Sakai Factory, and its test production of 200 ~ 300 kg will begin soon. The trial product has a purity of 99.9% up and a cost reduction compared with the conventional method is expected. The company is now studing its practical use in co-operation with users from several companies. Practical use is expected within the next year and they are planning to develop the demand in domestic and foreign markets in addition to the electrical industry.

In the case of its application for condenser et al. in the electric at industry, a substantial cost reduction is hoped for, because the cost per kilogram of TCNQ is about 1,000,000 yen.

The company started to develop the new synthetic method two years ago, and succeeded in producing a high-purity product. Practical testing is under way in co-operation with major domestic users, and a cost reduction is expected. Monthly production is planned at 2 ~ 3 tons.

Its applications are considered to be as an alternative to manganese dioxide for electrolytic condensers, aluminium condensers, pyrogen, and other practical uses.

CSO: 4120

SCIENCE AND TECHNOLOGY

DEVICE FOR BOILING POINT MEASUREMENT DESCRIBED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 78

[Text] * Denki Kagaku Keiki Co. has developed and begun marketing a boiling-point measurement device, the "BPA series", which has a pressure-resistant and anti-explosive design, for use in petroleum refineries.

In the process of petrolum refining the measurement of the boiling point is very important in quality control of products. The company succeeded in producing boiling point measurement device for the first time as a home product.

Frame-arresters of manifold ring type developed by the company's own technology are used in the outlet and intake of the sample and in the connecting elements of the device as a safety measure for preventing the leakage of the sample. The distillation test is repeated, and the temperature of the distillate can be recorded automatically in a simple operation by pushing a "start" button.

The meter also has the following features: (1) Several of 6 points, corresponding to 5%, 10%, 50%, 90% and the end point of distillation, can be selected. (2) A light-emitting luminous diode is used as a photoelectric sensor. (3) The trouble caused by the opening and closing of a fluid line seldom occurs thanks to the use of a adopting pneumatic valve. (4) Maintenance is made easy by the use of a throwaway stainless steel which prevents errors due to contamination and the possible breaking of the container.

The main specifications are as follows:

The type of measurement: batch distillation
Sample size : 30cc
Time for measurement : 30 min.
The range of standard measurement :
Naphtha : 0 ~ 200°C
Gas oil ~ 400°C
Kerosene ~ 300°C

CSO: 4120

SCIENCE AND TECHNOLOGY

INTERFERON TO BE PRODUCED COMMERCIALLY

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 82

[Text] Green Cross Co. & Toray Ind. will establish a technique to produce interferon on a commercial scale. Interferon is a protein containing sugar of 20,000 or higher molecular weight. Interferon, produced according to genetic codes of cells, is said to generate and antiviral protein which selectively impedes virus proliferation in cells but does not act on various viruses. It is an important factor in the biophylactic mechanism. Since interferon has specific actions peculiar to species, interferon that is effective for the human body must be produced from human cells.

Attempts to apply these actions to treatment of viral hepatitis and malignant tumors are non gaining momentum both at home and abroad. In the field of malignant tumors, however, development of pharmaceuticals, especially effective against cancerous cells, lags behind because the carcinogenic mechanism has not yet been made clear and metabolic proliferation of cancerous cells resembles that of normal cells. Most drugs now available are recognized as cancer-inhibitive, but act also on normal cells. Under the circumstances, development of interferon free from toxicity and side effects is expected to prove a boon to many patients suffering from carcinomas.

Now, interferon is at the stage of clinical study. Most interferon used is lenkocyte derived interferon of the National Serum Research Institute with the cooperation of the Finland Red Cross. This, however, is subject to restrictions in securing blood. The total production in 1979 was only 1g which is sufficient for clinical tests.

Under the plan of Green Cross Corporation and Toray Inc., human cells are treated with inducers such as viruses and nucleic acid outside the body.

The company aims to turn it into a highly safe drug applicable to a wide range of medical fields.

Usually, interferon is produced either through leukocytes, L type, or human diploid cells, F type, Green Cross aims at production of the type L, and Toray the type F. Green Cross Co. and Toray Ind., have been given development subsidies of ¥880 million and $870 million respectively, and are scheduled to produce interferon at a monthly rate of 4 billion units. In parallel to the development of commercial-production technology, clinical tests will be conducted by using samples obtained. Both companies, as members of the research group for clinical tests of the Ministry of Health and Welfare, have been carrying on clinical tests to prove the efficacy of interferon on deratitis and viral efflorescence, and have obtained reliable data. They are planning to provide the group with 1,2 billion units, and to perform clinical tests in the domain of malignant tumors and viral hepatitis. In addition, development work on another method is under way, in which interferon is produced on a large scale by gene recombination.

CSO: 4120

SCIENCE AND TECHNOLOGY

LIFTED SEA WATER POWER GENERATION

Tokyo TECHNOCRAT in English Vol 13 No 11 Nov 80 p 88

[Text] • The Ministry of International Trade and Industry and the Electric Power Development Company in cooperation with the Okinawa Electric Power Co. have decided to construct a lifted seawater power generation plant using the Pacific Ocean as a bottom pond.

Lifted seawater power generation is a form of hydraulic power generation which will lift up seawater of the Pacific Ocean into a top pond by making use of excess electric power available during the night and which generates electric power by using the head of the stored seawater from the top pond in the daytime when there is a large demand for power.

The plans made show that the Ministry of International Trade and Industry will commission the Electric Power Development Company to prove a variety of basic techniques by 1983, including the following: 1) electrical corrosion control and painting techniques for metals used; 2) deposition characteristics of marine life and methods of removing depositions; 3) effects of seawater penetration and tidal winds on the top pond and measures to control them; 4) effects of variations in temperature and flow rates of water being charged and discharged, and measures to control them; 5) development of new brine-resistant and pressure-resistant materials for the top pond; 6) development of materials for hydraulic pressure ducts such as glass fiber reinforced plastics (FRP) and asphalt lining and other methods of lining; 7) measures to protect concrete structures against seawater; and 8) tests of model pumps and turbines for submarine operation.

Also, the plans show that the construction of a 150,000 kW power plant will be started in 1983 to be completed in 1987, which will be followed by proof test runs including reviews of maintenance for about 2 years.

The Ministry explains that although lifted seawater power generation costs more for measures for protection against salt water, economically it can complete successfully with freshwater schemes because it does not necessitate the construction of a bottom pond. On the basis of the results of 150,000 kW proof tests, the Ministry will plan for a 1 million kW large-size seawater lifting power generation scheme.

CSO: 4120

SCIENCE AND TECHNOLOGY

COMPOSITE MATERIAL USES, NEW PERIODICAL NOTED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 84

[Text] • Textile companies are collection information about carbon fiber composite materials used in aircraft from the Society of Japan Aerospace Industry. Responding to this, the Society has issued a periodical publication in which they gave prominence to new composite material for aircraft.

The companies are mainly gathering reference data on practical applications of carbon fiber composite materials, future prospects, makers, and the technical trends. For example of practical application, they have collected detailed data of the F-15 fighter, as to its parts of composite material, strength, and properties.

The Japanese textile industry is the largest manufacturer of carbon fiber for composite material in the world. Toray Industries Inc. and Toho Rayon Co. are supplying 70 percent of the world's carbon fiber demand, and also they have exported technology knowhow. However, Japanese carbon fiber makers have fallen behind in development of applications for aircraft parts. It was '74 when the research for such applications was started by the Technical Research and Development Institute of the Defence Agency. And, it was only two or three years ago that cooperative research between textile maker and aircraft maker was jointly started. As it is expected that mass production of items for aircraft is effective using the composite material, the makers are keenly proceeding with the development of applications for carbon fiber composite material.

According to the society, the weight of an aircraft can be reduced by approximately 6 percent by replacing aluminum alloy with the composite material. And, by lightening engine and landing gear, etc, the weight will be further lowered by thirty percent. Though, in the case of the F-15 fighter, the composite material is 1.5 percent of its total weight, it is increased to 15 percent in the newest F-18 fighter. The percentage will reach 40 percent in fighters designed after five years.

CSO: 4120

SCIENCE AND TECHNOLOGY

ELECTRICAL UNITS FOR MARINE OIL WELL BORING RIGS MANUFACTURED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 88

[Text] * Mitsubishi Electric Co. has for first time in Japan manufactured all the electrical units for a submarine oil well boring rigs.

Technology for submarine oil well boring has almost been monopolized by American companies and recently such companies have been reluctant to transfer this technology to Japan. Under the circumstances, it is quite significant that a Japanese company has manufactured the electrical units, though only electrical units, independently, by its own technology. On the basis of this success, the company intends to establish various boring technology systems including those for geothermal power generation.

The electrical units completed are a series of units for operating and backing up excavators, including DC motors, thyristor boards, generators and AC distribution boards.

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SCIENCE AND TECHNOLOGY

MOTOR BOAT FOR DEEP-SEA SUBMARINE SURVEYOR LAUNCHED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 88

[Text] * "Natsushima", the mother boat for a deep-sea submarine surveyor, which has been under construction for the Marine Technology Center at Kobe Works of Kawasaki Heavy Industries, has now been launched.

The boat is part of a deep-sea submarine surveyor system which has been planned and designed by the Center and the Science and Technology Agency. It is 67 m long, 13 m wide and 6.3 m deep, total tonnage 1500 t, sails at a speed of about 12 knots, and accommodates 55 persons.

The boat is intended to load and carry a submarine surveyor to the site of surveys and thus is equipped at its stern with an A-frame crane for taking up and letting down the submarine surveyor. Also, in order to extract full performance of sonic instruments, measures have been taken to reduce submarine noise radiation.

In addition, the submarine surveyor, which has been named "Shinkai (Deep Sea)", will be launched next spring.

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SCIENCE AND TECHNOLOGY

DETECTION, LOCATION OF LEAKS IN PIPELINES DESCRIBED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 89

[Text] *The Mechanical Engineering Laboratory is developing methods of detecting defects such as damage and leaks in pipelines in submarine oil production systems and estimating their extent and locations, as part of "research and development on submarine oil production systems", a large project being promoted primarily by the Ministry of International Trade and Industry.*

The pipeline defect diagnosis system, to be developed consists of an on-line detection system which monitors variations in vibration, sound and pressure of pipes and valves, and on-line detects damage and leaks from the results. A scanning trouble detection system which precisely searches for such damage and leaks by running in the fluid in the pipeline, an inspection pig (a kind of capsule) equipped with leak or flaw detection equipment together.

As one item of this R&D, a method of detecting and locating leaks in pipelines using a pressure gradient method with an application of Akaike's information content standard (AIC) has been developed. It is outlined below.

Trouble Detection by AIC

The system concerned is recognized as a dynamic system and its output is applied to a self-return model in such a manner that AIC will be minimum. Trouble in the system will be recognized by observing this AIC. In other words, trouble will be detected by the following processes:

1) Variations $\{f_i\}$ in levels which are characteristics of the dynamic system concerned will be measured.

2) $\{f_i\}$ $i=1,2 \ldots n$ will be applied to a self-return model given by the following equation:

$$f_k = -\sum_{i=1}^{m} a_i f_{k-i} + e_k$$

where n is the frequency of sampling,

e_k white noise,

m

the power of model and,

a_i a coefficient

3) AIC will be calculated by using the following equation to determine a model with a minimum AIC:

$$AIC = n\, l_n \widehat{\sigma}^2_e + 2m$$

$$\widehat{\sigma}^2_e = \sum_{k=0}^{m} \widehat{a}_k \widehat{r}_k$$

$$\widehat{r}_j = -\sum_{k=1}^{m} \widehat{a}_k \widehat{r}_{k-j}, \quad j=1, 2, \cdots, m$$

$$\widehat{r}_k = +\sum_{i=1}^{n-k} f_i f_{i+k}$$

4) Then, the following will be obtained:

$$DAIC = [AIC]_k - [AIC]_{k-i}$$

5) From the result, the following diagnoses can be made:

the system is normal if $DAIC \geq 0$

the system is in trouble of $DAIC < 0$

Leakage Detection by Pressure Gradient Method

The above trouble detection method is applied to leakage detection which detects leakage from a difference in the pressure gradient between the upstream and downstream sides of a pipeline and enables leaks to be detected in gas pipelines and 2-phase fluids (such as gas-oil mixture) pipelines.

This method is based on the following reasoning. As a leak index characteristic of a system, the following value is used:

$$f_i = {}^1P_i^{(b-1)} \partial\, {}^1\widetilde{P}_i / \partial x - {}^2P_i^{(b-1)} \partial\, {}^2\widetilde{P}_i / \partial x$$

where $\partial{}^j\widetilde{P}_i/\partial x$ is the variation in pressure gradient at time i and at point j, ${}^jP_i$ the pressure at time i and at point j and, b a constant determined by the gas-oil ratio, which is 1 for liquid flows, 2 for isothermal gas flows and values between 1 and 2 for 2-phase flows.

Fig. 1 shows the conceptual diagram of the test system and Fig. 2 an example of measurement of pressure gradients on the upstream and downstream sides. Table 1 shows an example of calculation of DAIC with the above example of measurement. Leakage is detected when DAIC/N turns to be negative. This example involves small leakages for 2-phase flows, which cannot be detected by human monitoring of pressure variations as shown in Fig. 2. Where human monitoring can in some way tell leaks, DAIC largely turns negative and a leak can be detected as soon as it occurs.

Thus, the newly developed leak detection system is applicable to gas flows and 2-phase

flow pipelines and exceeds conventional methods in accuracy by a factor of 10.

Location of Leaks

When a leak is detected in trouble diagnosis of a pipeline, it is then necessary to locate it. Thus, as a method of leakage location in the pressure gradient method, a method using an interrelation method has been newly developed. This method is based on the following principles. As shown in Fig.3, in quadratic approximation of pressure gradients in 2-phase flow pipelines, any leak causes a discontinuous point. The leak is located by making use of this. Of course, the pressure gradient is represented by a straight line if the flow is liquid.

By giving variations in the pressure gradient of a pipeline by equation (1) to locate leaks, the following equation is obtained:

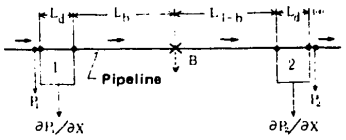
$$\frac{X}{L} = \frac{{}_1P^{(k-1)}\partial^1\tilde{P}/\partial x - {}_2P^{(k-1)}\partial^2\tilde{P}/\partial x}{{}_4P^{(k-1)}\partial^2\tilde{P}/\partial x}$$

Because measurements here, which vary at random, have to be processed statistically, a sequantial estimation algorism has been developed to obtain values with errors minimized by the method of least squares. An example of estimation results is given in Fig.4. This method enables leaks to be located relatively early and accurately.

Studies, are being promoted on the method of measuring b with 2-phase flows and its application to pipeline systems where temperatures vary. Also, application of the trouble detection method is being made to leak detection using sound, created by leakage.

Table 1. Results of DAIC Calculation

Sampling time	AIC	DAIC / N	Power of self-return model
1-1000	7026	---	9
1-2000	13986	0.00223	9
1-3000	20882	0.00395	13
1-4000	27967	0.00021	22
1-5000	34948	0.00171	22
1-5600	39266	0.00043	22



● : pressure measurement point; x : leakage

Fig. 1. Sketch of Test System

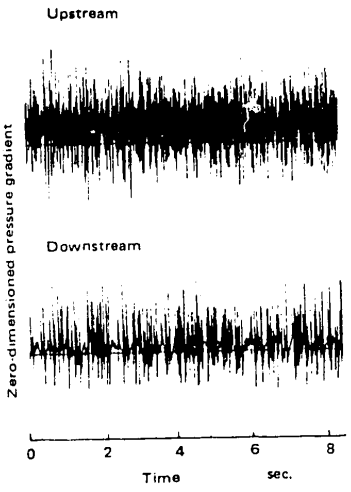
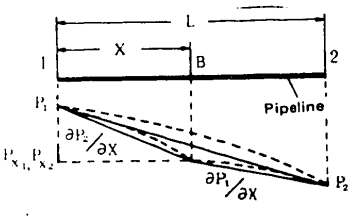


Fig. 2. Example of Pressure Gradient Measurement (2-Phase Flow)



Point B: leakage point; Solid line: liquid flow; Dotted line: gas flow

Fig. 3. Pressure Drop Curve for Pipeline

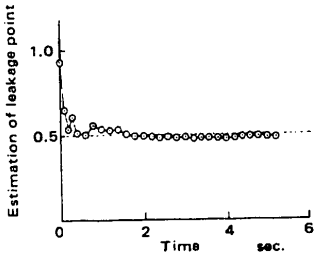


Fig. 4. Result of Calculation for Estimation of Leakage Point

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SCIENCE AND TECHNOLOGY

LARGE EARTHQUAKE-PROOF TESTING EQUIPMENT BEING INSTALLED

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 90

[Text] Construction of large earthquake-proof testing equipment--Tadotsu Engineering Laboratory of the Nuclear Power Engineering Test Center--the largest in the world, is progressing at Tadotsu-cho, Kagawa Prefecture. Recently, a vibrating table, which is the core of the equipment, has been transported to the site and installed. The table has a box shape 15 m long, 15 m wide and 3.5 m high and can carry a test piece of upto 1,000 tons maximum. The laboratory has been under construction since 1977 and it is scheduled to start the test operations April 1981.

CSO: 4120

SCIENCE AND TECHNOLOGY

EARTHQUAKE-PROOF SAFETY STANDARDS FOR CITY GAS

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 90

[Text] The Ministry of International Trade and Industry has decided to start working out safety standards for city gas pipes and gas fixtures in cooperation with the Japan Gas Association.

More precisely the pipe distribution network for city gas, for which earthquake-proof design standards have been worked on since 1979, will be completed in 1981. Safety measures for gas consuming devices have the following three themes to be tackled. (1) designation of gas fixtures by a government ordinance, (2) safety standards for devices, and (3) consolidation of gas companies.

Performance tests will be conducted for gas appliances (6 appliances such as instantaneous hot-water heaters, stoves, and pressure pots) so as to work out new safety standards. Various performance tests will be conducted for gas excess flow prevention and gas interrupting devices, for which safety standards have not yet been established, so as to start work for preparing safety design standards. A committee has already been set up in the Japan Gas Association and positive steps are proceeding for the consolidation of gas companies.

That there are 14 kinds of city gas throughout the nation at present, having different calorific values from each other, means gas appliances lack interchangeability and require modifications to combustion control to be made when users move residence. Accordingly, it is desired to consolidate 14 levels of city gas into a smaller number to overcome such inconvenience.

CSO: 4120

SCIENCE AND TECHNOLOGY

NEW CONSTRUCTION METHOD FOR CONVEYING CONCRETE

Tokyo TECHNOCRAT in English Vol 13, No 11 Nov 80 p 90

[Text] Kajima Corp. has recently completed penstock construction of the Oku Yahagi Pump-up Power Plant using a new method for conveying concrete known as the "snake shoot construction method" by which concrete is placed at a portion having a high head. The company has so far received 10 orders for this method and has executed them. The company desires to expand use of the system for construction where concrete is placed deep underground such as in the pits of underground power plants, subways, and underground passages.

The construction method uses a concrete feeder and a flexible hose of wear-resistant rubber. When the valve of the feeder is opened, concrete falls down through the flexible hose, and is led underground. In this case, if concrete falls freely, it accelerates and can cause accidents. To prevent this, concrete is conveyed through the hose of special design so that it functions like a snake swallowing a frog. This enables a given volume of concrete to fall at a fixed speed and at regular intervals, sensors are provided along the rubber hose to monitor the flow conditions of the concrete.

Thus, this construction method is not only good from a safety point of view but also permits concrete to be placed in any deep underground site by merely joining lengths of the rubber hose together.

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END