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12 DECEMBER 1986

Japan Report

SCIENCE AND TECHNOLOGY

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JAPAN REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

BIOTECHNOLOGY

Approaches to High Sensitivity Enzyme Sensors Discussed
(BIO INDUSTRY, May 86) 1

ENERGY

Research on Heat-Supplying Small Fuel Cells Reported
(ZAIKAI TEMBO, Sep 86) 10

INDUSTRIAL TECHNOLOGY

Issues of Technological Development of Machining Centers
(Takeshi Yasui; KIKAI TO KOGU, Jun 86) 15

NEW MATERIALS

Trends in Amorphous Alloys Discussed
(KOGYO ZAIRYO, Aug 86) 21

NUCLEAR DEVELOPMENT

Changes of Regulations for Nuclear Operations Announced
(GENSHIRYOKU SANGYO SHIMBUN, 25 Sep 86) 26

Nuclear Fuel Cycle Project in Aomori Discussed
(GENSHIRYOKU SANGYO SHIMBUN, 25 Sep 86) 28

FBR Safety Plans Discussed
(GENSHIRYOKU SANGYO SHIMBUN, 25 Sep 86) 29

TELECOMMUNICATIONS

Competition for New Media Control Discussed
(Shiro Kamizono; ZAIKAI TEMBO, Aug 86) 30

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APPROACHES TO HIGH SENSITIVITY ENZYME SENSORS DISCUSSED

Tokyo BIO INDUSTRY in Japanese May 86 pp 12-17

[Text] This report presents a new approach to highly sensitive enzyme sensors in relation to enzyme immobilization techniques and measuring device techniques. Sensitivity up to 10^{-9}M has been obtained by the introduction of such new techniques as chemical amplification. Further developments are expected in the future.

1. Introduction

Studies of enzyme sensors have been carried out[3-8] since reports by Clark & Lyone[1] and Updike & Hicks[2] were presented in the 1960's. However, some of their features have not been improved. One of them is sensitivity. The sensitivity of enzyme-sensors, or the minimum detectable concentration, which has already been reported is generally 10^{-4}-10^{-5}M with few exceptions exceeding 10^{-6}M.[5-7] This value is not high compared with the widely used analytic method, the spectroscopic analysis using enzymes in solution, and is much lower than the value obtained by fluorescence analysis.

Because enzyme sensors can be handled easily, new applications will open when sensitivity is improved to the level of fluorescence analysis. For instance, body fluid analysis, cell constituents, and the detection of fermentation intermediates will be automatized and become routine, which would eventually influence such areas as clinical medicine, legal medicine, biochemistry, and industrial measurements.

Since an enzyme sensor consists of immobilized enzymes and measuring devices, techniques concerning these two elements are the keys to its improvement. Therefore, in this report, studies or highly sensitive enzyme sensors with the sensitivity of 10^{-6}-10^{-9}M are discussed in relation to the two techniques. In addition, studies carried out by the authors are also introduced.

2. High Sensitivity by Improving Enzyme Immobilization Techniques

Figure 1 shows the widely used immobilized oxidase layer/O_2, or H_2O_2 electrode enzyme sensor. This is a device where the reduction of O_2 or the increase of H_2O_2 based on the oxidation reaction of the substrate RH_2 in the immobilized enzyme layer (RH_2 oxidase). $RH_2 + O_2 \rightarrow R + H_2O_2$, is detected by a change in electric current on the O_2 or H_2O_2 electrode. The glucose sensor used for measuring blood sugar has a structure of this type.

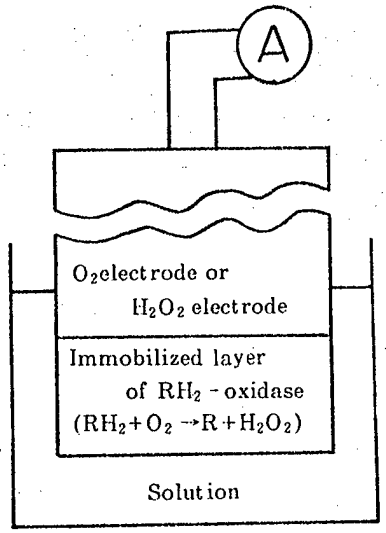

Figure 1. Example of Structure of Enzyme Sensor

What kind of improvements can give high sensitivity to such enzyme sensors? One way is to control such parameters as the diffusion constant of RH_2 within the layer and RH_2 oxidase activity in the immobilized enzyme layer. The other is to amplify chemically the reaction in the layer.

2.1. Parameter Control of Immobilized Enzyme Layer

In the enzyme sensor shown in Figure 1, the extent of change in electrode current, or the signal size is determined by the RH_2 diffusion rate within the layer and the reaction rate of RH_2 within the layer.[9-11] Theoretically, if both the diffusion and reaction rates are high, the signal will also be high, which will lead to high sensitivity. When an immobilized layer that satisfies these conditions was used, high sensitivity was obtained. For instance, Koyama[12] obtained the sensitivity of 10^{-6}M with a glucose sensor comprised of O_2 electrode and the immobilized glucose oxidase layer synthesized with triacetyl-cellulose, glutaraldehyde, and triamine. The authors' measurement showed that the layer had excellent qualities[13] with a constant diffusion of $1 \times 10^{-6} cm^2 s^{-1}$ and enzyme activity (per unit volume per layer) of about 30 U cm^{-3}. Other than this, the aminated acrylnitril layer[14] and the photobridged polyvinyl-alcohol layer[15-17] which will be discussed below are useful materials.

On the other hand, there is another method in which an enzyme is densely immobilized without using excessive membranes. Yao[18] formed a glucose sensor with a sensitivity of 10^{-7}M where GOD was densely immobilized on the surface of a platinum electrode, as shown in Figure 2.

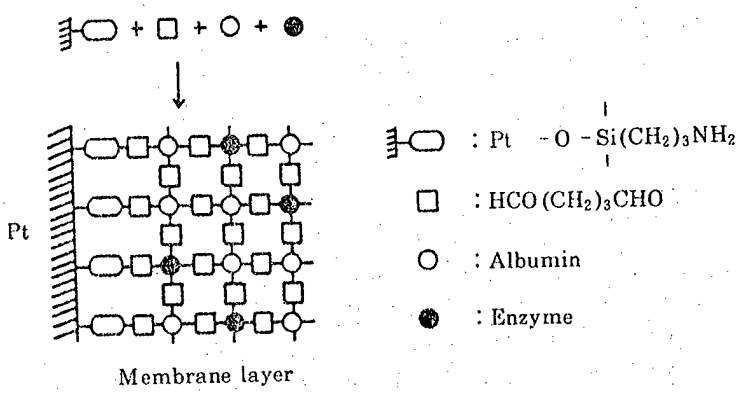

Figure 2. Construction of Sensor With Electrode Modified With Enzymes[18]

2.2. Introduction of Chemical Amplification

If the change in concentration of O_2 or H_2O_2 can be increased in a low level RH_2 solution through chemical amplification, it will be convenient for forming highly sensitive enzyme sensors. The application of enzymic cycling[21,22] satisfies these conditions. This method is shown in Figure 3: R produced by the reaction with RH_2 oxidase is reduced enzymically to form RH_2, many O_2 molecules are consumed and H_2O_2 are generated through this oxidation-reduction cycle. Enzyme sensors of this type have been successively devised by the authors[22,23] and Scheller.[24,25]

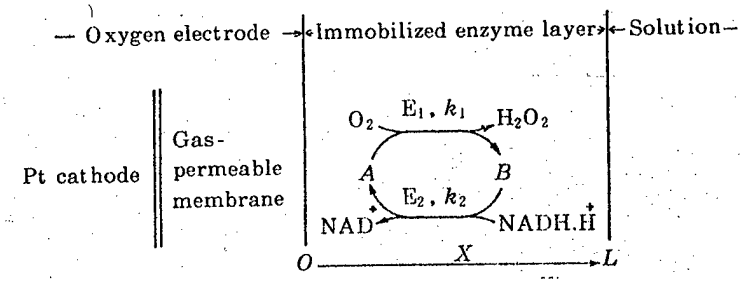

Figure 3. Structure of Chemically Amplified Enzyme Sensor[23]

A: Substrate (RH_2)
B: Oxidized substrate (R)
E_1: RH_2-oxidase
E_2: RH_2-dehydrogenase
k_1, k_2: Quasiconstants in primary reaction of E_1 and E_2

In a Figure 3 type sensor, chemical gain N is given by the ratio of a signal emitted by the cycle reaction in the presence of a reducing agent NADH to a signal emitted by the reaction which proceeds only in the presence of RH_2 oxidase and without NADH. The sensitivity increases N times theoretically (the minimum detectable concentration lowers to 1/N). The authors obtained

the maximum value of N, 250, with a sensor consisted of lactate oxidase (LOD) and lactate dehydrogenase (LDH).[23] In this case, the sensitivity reached to 5×10^{-9}M, the world's highest value.[23] While, Scheller composed a sensor for NADH, glucose, and lactic acid with the use of peroxidase-glucose dehydrogenase (GDH), GOD-GDH, and LOD-LDH, respectively. The value of N in these sensors was around 10, and the sensitivity was in the order of 10^{-7}M.

So far it has been found that chemical amplification is very effective when promoting enzyme sensor sensitivity. But, why is the value of N higher in the authors' experiment[3] compared with Schellers[24]? The authors considered that using a layer satisfying the following four conditions makes N larger: 1) large k_1, 2) large k_2/k_1, 3) large L (thick immobilized enzyme layer), 4) the diffusion constants of RH_2 and R in the layer are small (Figure 3 to identify what k_1 and k_2 mean). However, conditions 3) and 4) adversely affect the sensor's response in various ways, and therefore 1) and 2) are particularly important. That is to say, forming a layer with two active enzymes immobilized on it is required to increase the value of N. Figure 4 is a graph[23] showing the values of N when a photobridged polyvinyl-alcohol layer[15-17] with k_1 being 2.7 s^{-1} (LOD activity 72 U cm^{-3}) and k_2 being 12 s^{-1} (LDH activity 120 U cm^{-3}), and another carrier with k_1 being 1 s^{-1} (LOD activity 16 U cm^{-3}) and k_2 being 1.1 s^{-1} (LDH activity 11 U cm^{-3}) were used. It shows the importance of k_1 and k_2, and LOD or LDH activities. The reason why the authors could give the layer the high N value, or high sensitivity, was that they employed the photobridged polyvinyl-alcohol layer satisfying the conditions 1) and 2). If a layer was able to carry enzymes at the activity of nearly 100 U cm^{-3}, the value of N in 10^2 order can be obtained. It is necessary to find a new layer with higher enzyme activity in order to make the value of N much larger.

3. High Sensitivity by Improving Measuring Device Techniques

In a Figure 1 type enzyme sensor, what kind of improvement is required in order to get high sensitivity? One way is to adopt a method reducing the electrode's noise, and the other is to use a more sensitive device compared with the electrodes.

3.1. Improvement of Electrodes

There are comparatively many studies aiming at high sensitivity by reducing noise with the improvement of electrode design. If noise is low and drift is small, high sensitivity will be easily obtained by electrical amplification.

Thevenot's study[26] is a successful example of this method. In this study, as shown in Figure 5, glucose was measured by the difference in output between the electrode immobilizing an enzyme, GOD, and the other which does not immobilize an enzyme, and has a sensitivity of 10^{-8}M. The key to this technology is to produce a layer which is able to maintain a constant output difference in a solution of various different constituents. Clark[5] and Johnson[27] have obtained high sensitivity by devising an electrode system.

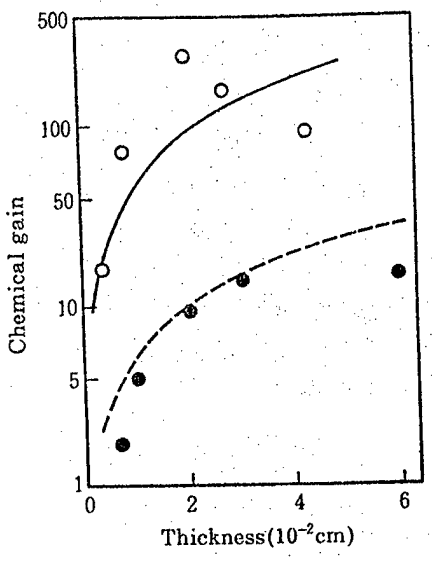

Figure 4. Relationship Between Chemical Gain in Chemically Amplified Lactic Sensor and Thickness of Immobilized Enzyme Layer

o : Photobridged polyvinyl alcohol layer is used
o : Layer, of which the major constituent is acetylcellulose, is used
—— : Calculated chemical gain when a photobridged polyvinyl alcohol layer is used
--- : Calculated chemical gain when acetylcellulose-based layer is used

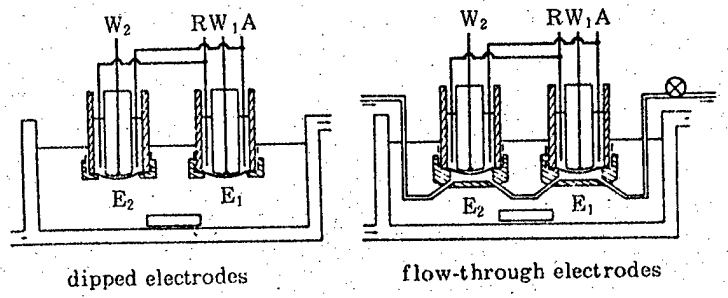

Figure 5. Structure of Enzyme-Sensor Using Differences in Output[26]

Rotating the electrodes is another method. As shown in Figure 6, if a platinum electrode to which an enzyme layer is adhered for detecting H_2O_2 rotates, the solution moves rapidly toward the electrode by convection. When the enzyme activity on the layer is high enough to correspond with this rapid flow, the signal becomes larger.[28] Noise and drift can be controlled by controlling the flow, which also contributes to increasing the sensitivity. The authors devised a glucose sensor with a sensitivity of 10^{-8}M by using a system consisting of the said photobridged polyvinyl alcohol layer with immobilized GOD.[29]

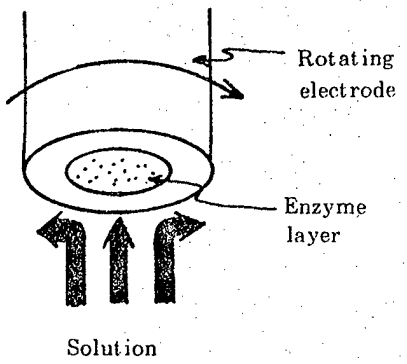

Figure 6. Rotating Enzyme-Electrode and Flow of Solution

3.2. Introduction of Highly Sensitive Device

It is needless to say that enzyme reactions can be detected by other devices. Figure 7 shows an enzyme thermistor which detects heat produced by enzyme reactions. The most important characteristic of this thermistor is that it is available widely. It catches enthalpy changes that occur in any enzyme reaction and can analyze all kinds of enzymes.[3,30] Further, as the thermistor is a highly sensitive device measurable in high accuracy, a very small temperature change of 10^{-4}K, it shows high sensitivity to enzyme reactions with large enthalpy changes, such as the catalase reaction. The sensitivity of 10^{-4}M order has been reported on sensors for glucose, oxalic acid, and cephalosporin.[30] Recently, Scheller[25] succeeded in detecting 10^{-8}M lactic acid by employing the enzymic cycling method mentioned in 2.2 to the enzyme thermistor.

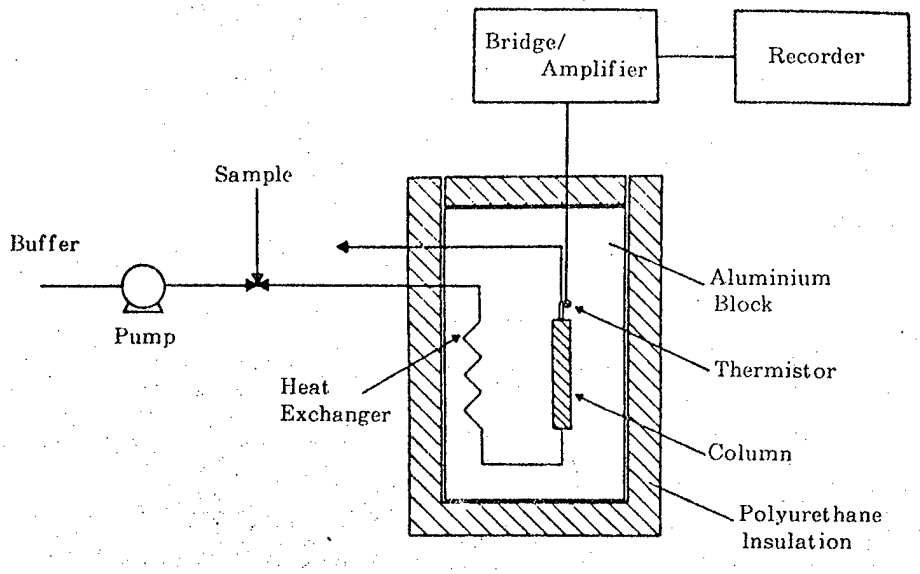

Figure 7. Structure of an Enzyme-Thermistor

A study in which products of enzymic reactions are led to luminous reactions, and which are detected by a photocounter, or a photocell were reported. Ikariyama[31] measured H_2O_2 quantitatively with a luminous enzyme sensor using photofiber as shown in Figure 8. On the other hand, Aizawa reported a simple device which consists of a luminous enzyme system attached to a photocell. At present, its sensitivity is not so high, but future development is expected as it employs in principle a highly sensitive luminous system.

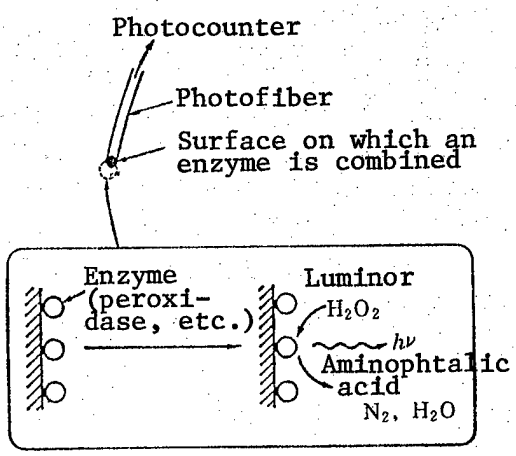

Figure 8. Structure of Luminous Enzyme Sensor[3]

4. Summary

In this report, some studies aiming at the high sensitivity of enzyme sensors have been introduced, and key technologies to improve sensitivity have been discussed. Enzyme sensors given the sensitivity of 10^{-8}-10^{-9}M have been formed,[23,25,26] and the accumulation of technologies obtained by these studies will lead to the construction of ultra high sensitive enzyme sensors with higher sensitivity. Integration of these sensors will produce a sensor system comparable to the five human senses such as taste and smell, and it will also have a large influence on bioelectrical areas.[3]

Although it has not been discussed in this report, there are some sensors which are given high sensitivity by detecting inhibitors.

FOOTNOTES

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RESEARCH ON HEAT-SUPPLYING SMALL FUEL CELLS REPORTED

Tokyo ZAIKAI TEMBO in Japanese Sep 86 pp 172-173

[Article: "The Kansai Electric Power Co., in Collaboration With the Osaka Gas Co., Begins Research on Small Fuel Cell That Can Supply Heat"]

[Text] The Kansai Electric Power Co. (Seiji Morii, president) and the Osaka Gas Co. (Masafumi Ohnishi, president) have decided to conduct joint research on a fuel cell that can simultaneously supply electricity and heat. These companies will carry out the joint research project on consignment from the New Energy Development Organization (NEDO). They are attracting considerable attention among interested circles because this is the first time that an electric power company and a gas company will carry out a joint research project despite the fact that they are competitors in the energy supply field.

The joint research project given in trust to both companies--the Kansai Electric Power Co. and the Osaka Gas Co.--will be a part of the Energy Conservation Technology Project (hereafter called the Moonlight Project) devised by MITI's Agency of Industrial Science and Technology (AIST) for the purpose of fostering energy conservation. The NEDO will explore a new demand area for the installation of fuel cells under the "Comprehensive Technology Development of a Phosphoric Acid Fuel Cell" project during FY 1986. Within this project these two companies have received in trust from the NEDO a request to study systems and conduct research on the operation of fuel cells that can be used by businesses in hotels, restaurants, etc. The research period is scheduled to be 5 years, from FY 1986 to FY 1990.

Fuel cells are manufactured by using a fossil fuel, such as natural gas or methanol. They are used to chemically generate electricity. They adapt excellently to various environments, and can be dispersed in demand areas. In addition, their overall efficiency will be 80 percent or more, because they can simultaneously supply heat. For this reason, electric power companies, gas companies, etc., are competitively developing the fuel cell for future use as a dispersed power source. However, if fuel cells are used only to generate electricity, they will be expensive. Therefore, the heat and electricity must be supplied by using waste heat from airconditioning systems, etc., and the cost of fuel cells must be reduced by mass producing them. These supply and cost reduction problems have been extensively considered.

To date, both companies have carried out research on the development of fuel cells. The Kansai Electric Power Co. is enthusiastically conducting research on the operation of fuel cells with a capacity of 1,000 kw as a part of the Moonlight Project. So far, the company has performed field tests on fuel cells with a capacity of 30 kw. Meanwhile, the Osaka Gas Co. is independently performing demonstration tests of a heat and electricity supplying system with a capacity of 40 kw. This system is made by the UT Co. in the United States.

Competent circles expect that both companies will fully use their technologies related to the use and supply of electric power, gas, and heat, and will greatly promote the practical commercial use of on-site fuel cells.

Up to now, electric power and gas companies have only competed with each other in the energy supply field. The relation between them has been keenly competitive in such fields as airconditioning systems, etc. But, both companies have been closely associated with each other because they are public utilities. However, as mentioned above, this is the first time in Japan that they have conducted joint research in the technical development field. Their earnest attitudes toward the future of energy supply will be closely evaluated.

As shown below, those in charge of the two companies' joint research have explained the reason why they will conduct this joint project.

The commercial fuel cell is a cogeneration system (supplying heat and electricity). In order to generalize this system for future user, it is important to ensure the quality of the electricity generated and to use the heat generated efficiently. Electric power system technology and heat supply technology are favorite fields of the Kansai Electric Power Co. and the Osaka Gas Co., respectively. Therefore, we are sure that the two companies will be able to contribute to the practical use of cogeneration-type fuel cells at an early stage by jointly conducting research on the operation of these cogeneration cells.

Expectation of Practical Use Is Great

As previously mentioned, both companies have received an order for research on 200 kw-class fuel cells for business use on consignment from NEDO. Town gas is used as a fuel in this system. The system is the compact package type, and employs an unmanned operating method. The two companies will conduct their research so that these fuel cells can have an overall efficiency of 80 percent or more (a generating efficiency of 36 percent or more and a thermal use of 40 percent or more).

Each joint research team will consist of about five researchers. The Kansai Electric Power Co. and the Osaka Gas Co. will be in charge of the electric power and heat supply systems, respectively. The entire fuel cell will be the joint responsibility of both companies.

With regard to the research schedule, the two companies will study equipment specifications, will design the electric power and heat supply systems, and

will request a design manufacturer (Mitsubishi Electric Corp.) to design the equipment and to manufacture the systems beginning this fiscal year and running into the next. They will install and adjust the equipment and systems on actual facilities in FY 1988. They will conduct demonstration tests on this equipment and systems in FY 1989 and 1990.

The following five items can be cited as principal research subjects of the Moonlight Project:

(1) The quality of electric power generated and system connecting conditions.

(2) The systems for using waste heat in airconditioning hot water supply.

(3) The unmanned system.

(4) Environment and security concerns where the equipment and systems will be installed in urban areas.

(5) Demonstration of load fluctuation, generating efficiency, reliability, and durability.

As shown below, one of the individuals responsible for the project has discussed economic efficiency.

For now, construction costs will be about ¥3 million per kw, but we will seek ways to reduce construction costs with the aim of realizing a construction cost of ¥700,000 to ¥1 million per kw. If equipment and systems are mass-produced and the cost of a facility becomes ¥200,000 to ¥300,000 per kw in the future, fuel cells will be able to compete economically against existing systems by using waste heat efficiently.

MITI's AIST anticipates that the system will be put to practical use around 1993. Also, it is said that the United States is promoting such a system with a view to starting initial introduction in the summer of 1990.

With regard to future marketability, it is estimated that from 1991-2005 fuel cells producing 10 million kw will be in operation. If so, these fuel cells may have an influence on the electric and gas utilities. Below, we will see how one of the project directors views this influence.

We will approach the electric utility as a type of dispersed power source that can be located in demand areas, and can approach the gas utility as an effective user of town gas. Therefore, it is anticipated that if in the future fuel cells can be put to practical use, both utilities will be greatly affected. We wonder if a field peculiar to the respective utilities will be determined naturally. In addition, we think that sound competition between both utilities will contribute to the development of new technologies and will benefit consumers.

As shown below, the Kansai Electric Power Co. has discussed the value of fuel cells as a power source and the relation between a fuel cell with a capacity of 30 kw and one with a capacity of 1,000 kw. The former fuel cell has already been constructed by the company, while the latter fuel is being constructed at the Sakai Port.

There is a possibility that fuel cells will become popular as a cogeneration power source because they adapt excellently to various environments. Cogeneration means that fuel cells will be dispersed to demand areas and that air-conditioning and hot water supply will be carried out by using waste heat generated from these fuel cells. In this case, it is anticipated that relatively large fuel cells will be used as a power source by electric utilities while relatively small fuel cells will be used as a power source for non-utility generation.

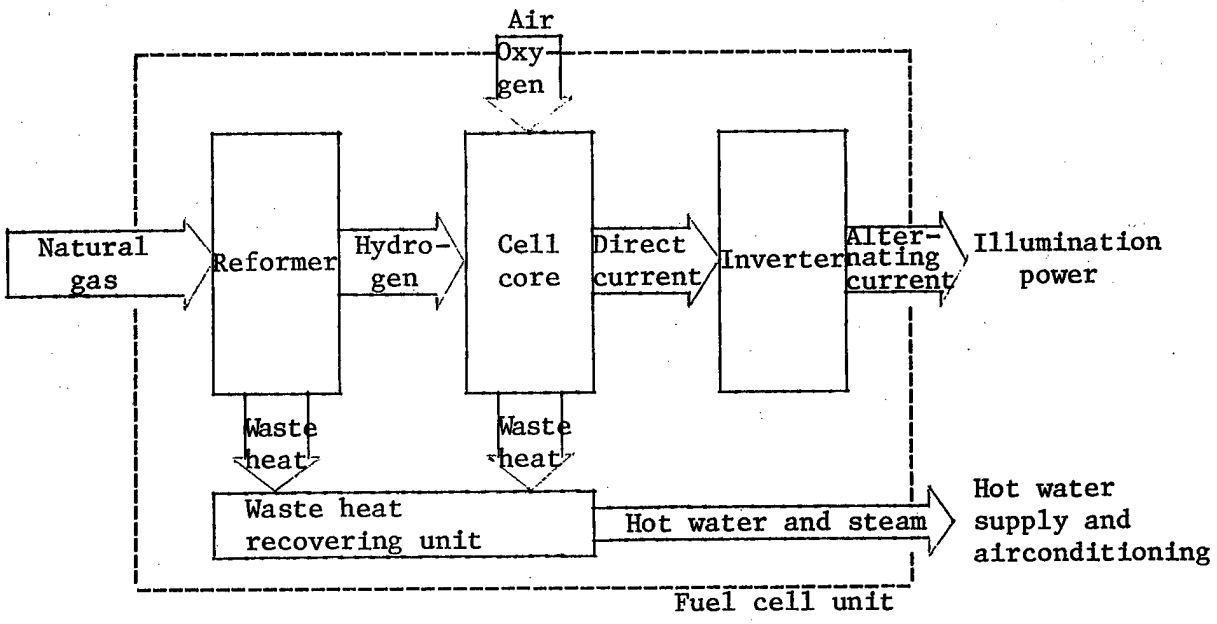
The Kansai Electric Power Co. has conducted research on fuel cells with a capacity of 30 kw at a power plant located in the Sakai Port in collaboration with Fuji Electric Co. This fuel cell, which is a model for basic experiments on phosphoric acid fuel cells, is being used to acquire basic technology and to realize the possibility of generating electricity. As mentioned, a fuel cell with a capacity of 1,000 kw is presently being constructed. It will be used as a plant to demonstrate the various characteristics of fuel cells for use by an electric utility. The fuel cell with a capacity of 200 kw is a cogeneration type. As previously mentioned, this fuel cell will be developed jointly by the two companies, and will be operated by using waste heat. New performance characteristics--such as compactability, packability, etc.--will be required of the fuel cell.

The amount of nitrogen oxide generated is small because only small amounts of sulfur and sulfur oxides are found in the natural gas used as the raw fuel for fuel cells, and because the reaction temperature is low. There is no anxiety about noise because the fuel cells generate electricity by chemical reaction. Therefore, it can be said that the fuel cells are clean energy sources.

Hotels, hospitals, restaurants, etc., have been selected for field tests. According to an estimate by MITI's AIST, an energy conservation rate of 15 to 30 percent over conventional systems can be expected.

Great results are expected from this research given in trust by NEDO to both companies. The research will be aimed at commercializing fuel cells.

System Configuration of Fuel Cell



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ISSUES OF TECHNOLOGICAL DEVELOPMENT OF MACHINING CENTERS

Tokyo KIKAI TO KOGU in Japanese Jun 86 pp 10-13

[Article by Takeshi Yasui]

[Text] 1. Introduction

NC [numerical control] lathe and machining center production exceeded that of the United States in 1970 and 1979, respectively. As shown in Figure 1, it has continued to increase sharply. The percentages of the two against overall NC machine tools are shown in Figure 2. Recently they were 23.7 and 17.3 percent, respectively. When both types are combined, the total accounts for 41 percent. This fact indicates that NC lathe and machining centers are not only used as a substitute for conventional lathes or millers, but also for various machine tools such as drilling and boring machines. It is evident also that these tools are used as a built-in part in a wide range of machine systems.

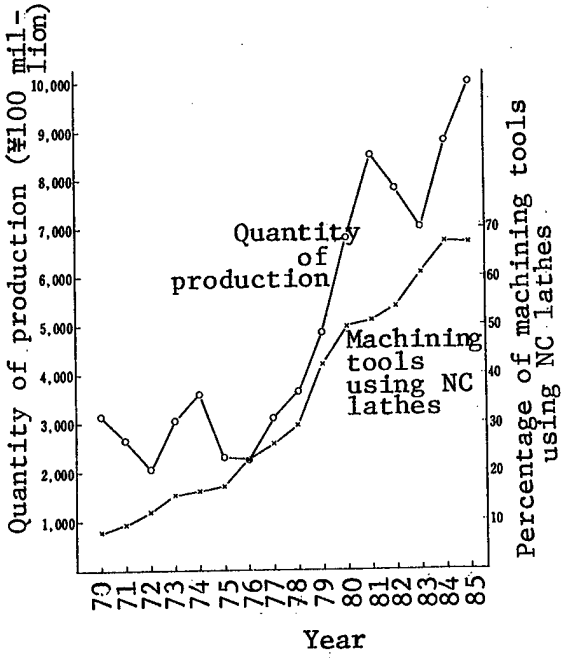

Figure 1. Japan's Machine Tool Production and Percentage of NC Lathes Usages

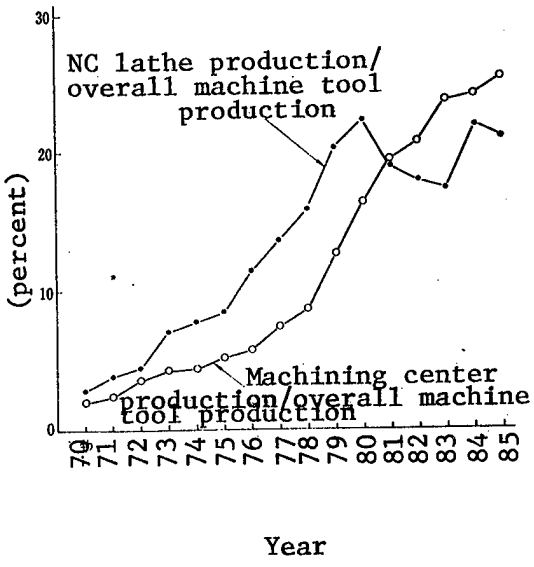

Figure 2. Percentages of Machining Centers and NC Lathes Against Overall Machine Tool Production

While a machining center has characteristics of extremely high general-purpose usages, the exclusively NC machine, on the other hand, has characteristics for productivity and suitability for system usage. The production of such NC machines is also on the increase each year. As shown in Figure 3, the production is about 10 percent of the machining center production.

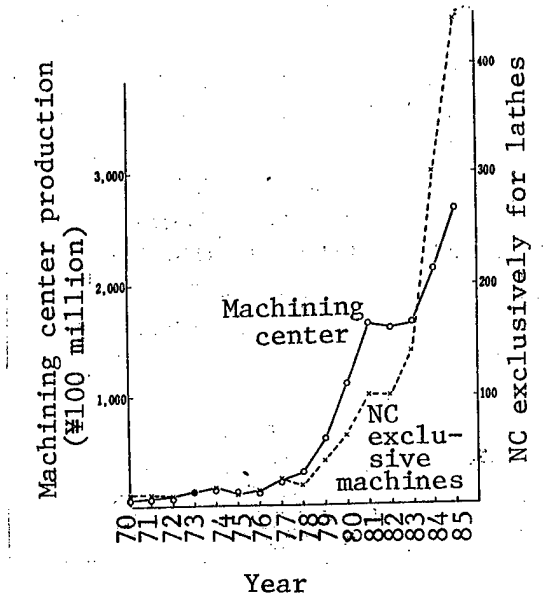

Figure 3. Production of Machining Center and Exclusive NC Lathes

As for NC lathes, on the other hand, not only are their turret heads changeable, but some also have a storage capacity of about 10 tools due to having the ATC [automatic tool changer] function. There is also a turning center which has drilling and milling capacity as well as turning capacity with a C axis control function, and production is active as shown in Figure 4.

In general, since flexibility is incompatible with productivity in machine processing systems, as shown in Figure 4, as a system the most appropriate arbitrary point must be selected. Various machining centers are now provided according to the most suitable arbitrary point of the system from FMC [flexible manufacturing cell] consisting of one small machining center or one turning center to large-scale, unmanned automated factories.

2. Future Issues of Technology Development

As previously mentioned, machining centers such as those only for box processing use account for 25 percent of the entire market share. If turning centers are included in a broad sense, the growth of the share exceeded 40 percent. Machining centers can now be said to occupy a position in which they are expected to take the lead in technology development of the entire machine tool field.

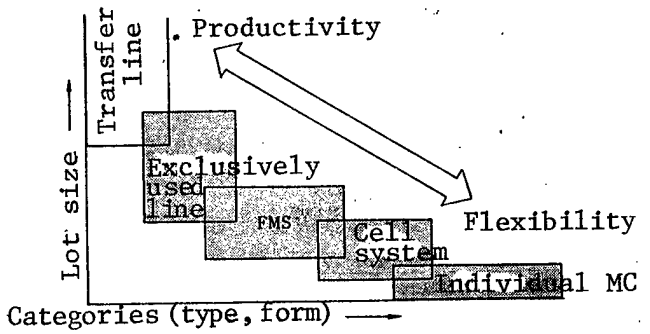

Figure 4. Production System and Lot Size

Also, as mentioned previously, although machining centers were basically diversified, the function and capacity of their basic elements, such as headstocks, control units, drive units, guide elements, and cast iron, have been progressively accelerating, manifesting monopolization. The extreme standardization of such basic elements developed by this monopoly, however, made it much easier to introduce CAD and make possible easier access to CAM with substantial benefits in drastically shortening the lead time from production planning to delivery.

In addition to this, it has another advantage. In the machining center field merchandizing was believed to be difficult without long years of accumulated technologies within the framework of comprehensive technologies. But now, when basic elements available on the market are purchased and simply assembled, products meeting the least minimum requirements of function and capacity can be manufactured creating easier environments for new business to enter the machine tool field.

The present machine tool industry, at least the Japanese machine tool industry, does not require extremely large-scale capital for industrial facilities as do the heavy chemical industries such as those represented by the steel and automobile industries. The constant keen competition among these many enterprises also enables new business participants to enter the field more easily.

However, this is not only a current problem for the domestic outsiders, but should also be judged from a global view, including the developing countries. Namely, excellent control equipment, ball screws, principal axes, and linear guides made in Japan may be purchased anytime, anywhere worldwide. It is an era in which a bare machine tool can be simply fabricated by assembling these parts.

As one of the future technological processes, it is therefore pointed out that technologies for such basic functions and machining centers of average capacity should be developed as quickly and cheaply as possible.

Even in Japan it is said that "FMS [flexible manufacturing system] cost is too high and should be reduced to half. If that can be done, it would enable manufacturers to invest unhesitatingly in plants and equipment." Some people

would be chilled by such a remark. In conjunction with the latest yen appreciation, the problem of reducing cost cannot be avoided.

Next, and more essentially is the need for development of an inherent technology. This is the capability to continue improvement and to develop exclusive, unique "technology" which cannot be copied easily or bought by others in the same business.

In the past, as in the present, the capacity of machine tools depends on precision guidance. In the days when the precision of the mother machine was insufficient, manual techniques and skills made up for the insufficiency of the machine's precision. Due to the improvement in the precision of the mother machine, hardened quenching guiding disks, decreased skilled labor, and the improved quality control of cast iron, "machine processing" progressed so that sufficient precision was successfully achieved. Although manufacturers' policy of adhering to their own unique technologies brought this success, they did not spend time strengthening and maintaining their own unique technologies thereafter. As a result, with the products of respective manufacturers together with standardized function and capacity, the situation was inevitably destined for price competition.

Especially in that progress within and outside had been promoted in innovative plants and equipment with functional progress as a weapon for nearly 20 years, supported by technology, progress in the basic development of NC control-driven devices was totally dependent on other industries. The fact that it was customary to adopt results achieved by other industries and that it had worked well up to now, however, is resulting in serious weakness.

And then, the functional improvement of machining centers by using control technology in a broad sense has almost reached its saturation point. The difference in the basic competitive power is gradually becoming less difficult with the sudden grains of A.G. Siemens of West Germany and others. Then, from now on it would become the era of the return of performance capability. It is indeed the difference in machine performance that will make the difference in the technology competition era. For this very reason manufacturing development of one's own inherent technologies, rather than depending on specialized manufacturing for basic parts, has been an urgent requirement.

In reality, it is necessary to enhance high precision by reducing by half the precision already achieved as in the highest axis (X-axis in the horizontal) of ±10 μm and in the other axis (Y, Z axis) of several tens of μm. Furthermore, by strengthening enhancement, etc., the attitude for experimentation would have to be one or even two steps ahead of other companies in technical development.

The third issue is to develop products with academic background and on a conceptional basis.

The pioneers of machine tools were endowed with novel ideas, not only having superior minds, but also having the ability for practicality where, in fact, numerous designs were put into practical use. Many, however, remained in the minds of a limited group of people buried in history. Due to the lack of

academic systematization, even though much experience is available, not only are the successors unable to make full use of it, but some efforts are wasted since the same mistakes of the forerunners are made.

In order to avoid such illusion and make effective progress by making full use of the experience of the pioneers, it is necessary to systematize the comparatively easy-to-execute academic validation to promote research based on that.

To leave the subject of the academic point of view, it is inappropriate to emphasize here the much talked about improvement in the vibration-decreasing capacity of concrete beds. The most disliked factor is the vibration caused by tool machines and objects which are not limited to machining centers, and next are such sources of vibration as the main axis system and the electric motors. The effectiveness of vibration-damping capacity will be drastically reduced if such vibration sources are not placed nearby. Since the bed is located at the farthest point, the vibration-damping capacity is high, but it cannot be relied on for internal machine vibration, only external vibration. It, therefore, has the effect of making it difficult for vibration to be transmitted from the floor or foundation to the area between a tool and its object. However, the current level of improvement in vibration-damping capacity does not produce any practical effect in preventing vibration. This is apparent from the fact that most machines which must be protected from external vibration use an air bed. In addition, it was made clear that the vibration-damping ratio of materials comprising the bed had no more than a 10-percent contribution ratio to that of the entire machine.

The machine tool bed is a supporting body for a guide disk. Stability in precision is therefore more important than vibration-damping capacity. Although only time will resolve the age-old question as to whether the naturally aged or artificially seasoned is superior, as far as the beds are concerned there is a justifiable theory. Changes of characteristics in precision as to changes in time and temperature should be brought up first with regard to bed materials. Then cost should be taken up, whether it is inferior or superior compared to cast iron, and vibration-damping capacity after that.

In the past, machine tools were totally dependent on the experience of individuals, but now they are being systematized with an academic backup. There are still some areas such as abatement processing where the need for practical academic research remains. Further progress will not be attained unless they are developed based on an academic basis. Only in this sense can results be expected from the currently popular, so-called industrial, academic, and government joint research.

The fourth issue is that much is desired for the improvement of machining centers, and it will be difficult to raise the manufacturing precision level to several μm, unless tools, objects, and attachment devices are considered. Expertise concerning the cutting process is imperative. It is also urgently necessary to train technicians who are knowledgeable about the cutting process. It is an era where the survival of enterprises depends on whether or not technicians who can sell are successfully trained rather than technicians who make machining centers.

3. Conclusion

Technology is recognized only when there is progress. When progress stops, it fails or perishes in one straight line. It must always continue to emerge from the present situation and not fail to challenge the as yet unknown world. Should the development and progress of machine tools stop, having sustained the foundation, especially in Japan, which has become a great economic country and one of the advanced industrial countries through excellent production technology, the serious effect would be a matter of great concern.

It should now be reconfirmed that the development of machining centers is the starting point for all machine tools, as well as for pioneering. It is hoped that the various problemical points will be resolved quickly and steadily.

20,134/9365
CSO: 4306/581

TRENDS IN AMORPHOUS ALLOYS DISCUSSED

Tokyo KOGYO ZAIRYO in Japanese Aug 86 pp 97-99

[Excerpts] Amorphous alloys, possessing the following advantages, were once considered extremely hopeful materials: not being crystalloids, amorphous alloys lack crystalline fields; possess uniform quality; and are extremely strong (their tensile strength is greater than 300kg/1mm^2; and wear-resistance is excellent with a Vickers number exceeding 1,000). They are, moreover, corrosion free, even in hydrochloric acid, and they have excellent magnetic properties. Amorphous alloys are especially attractive as materials for electric power transformers, since they are basically soft-magnetic alloys and their hysteresis loss is extremely small. Finally, since their electrical resistance is 5-6 times greater than that of crystalline metals, vortex current loss is small and iron loss is extremely small.

In the manufacturing of materials, the amorphous materials ordinarily require one fusion and one solidification process so that in comparison to crystalline-magnetic materials that require several complex heat treatment stages, there is considerable reduction in manufacturing energy. As energy conserving materials, therefore, it was once expected that amorphous materials would find quick application and grow in demand. In Japan, however, this has not been the case. Why?

Distant Transformer Market

1. Unclear Patent Complications

Regarding amorphous alloys, in the United States, Allied Corporation's basic patent rights--pertaining to heat-stable amorphous alloys--have been established. In Japan, the request was made in November 1973 and was made public in May 1985.

In the United States, the granting of patent rights is based on the primacy of the right of the inventor whose invention occurs within the country. This, as can be readily seen in the following case, is advantageous to U.S. industries. After 17 years of litigation, Phillips Petroleum of the United States won the basic patent rights to isotactic polypropylene, which [Monte Caccini ? [phonetic]] had claimed was the invention of [Chigura Natta ? [phonetic]]. (Japanese companies have recently obtained licensing rights to this patent.) In March 1983, on the basis of their patent rights in the United States and

claiming infraction of the article 337 of the U.S. Tariff Act, Allied Corporation asked the ITC (International Trade Commission) to stop imports of products manufactured by Nippon Steel Corporation, Hitachi Metals Limited, TDK, and [Vacuum Schmietz ? [phonetic]] of West Germany. (Article 337 prohibits imports of manufactured goods produced in infraction of U.S. patent rights.)

At the same time that this was going on, [Allied] made an effort to establish its basic patent rights in Japan. When the patent request was made public in May 1980 in Japan, Dr Ken Masumoto of Tohoku University and others objected to it. In 1982, after exchanges of claims between the two parties, the objection was sustained, but Allied took the matter to court.

Later, in January 1983, Allied won the litigation and their patent was established in Japan. It was rumored then that Allied took advantage of the atmosphere of U.S.-Japan trade friction that existed at that time to win the case. Later, the Japanese side brought a counter suit, and the dispute remains unsettled. In July 1984, concluding that "a portion of the manufacturing method infringes upon U.S. patent rights," ITC stopped imports of products (including those incorporating non-amorphous alloy products) from Japan and West Germany.

Even if Japan wins the present Japanese patent right battle, it would be difficult to move right into commercialization as long as Japan cannot export the alloys to the United States, which is her most crucial export market. Except for Japan Non-Crystal Metals Co. Ltd., which is a joint venture enterprise of Allied Corporation, Mitsui Petrochemical Industries Ltd., Toshiba Corporation and Mitsui & Co. Ltd., it is now necessary for Japanese firms to purchase the patent right. But in Japan, the amorphous alloy technology has been a part of large-scale "next generation basic technology" projects that had been carried out by MITI in cooperation with government, private industry and academic institutions. For this reason, the patent right battle is a difficult issue. Firms that have been trying to develop the technology are now taking a wait and see attitude and slowing down their work considerably. Only TDK has acquired a license from Allied Corporation.

2. Characteristics of Japanese Electric Power Market

A loss of power always accompanies power transmission. One-third of the power loss comes from the transformers on utility poles, though the loss may vary depending on the material used for the core of a transformer. In comparison to silicon steel plates, of which most cores are today made, the iron loss of amorphous cores is about 1/8. It is said that 6 billion kWh of power per year can be saved if the core is made entirely of amorphous alloy. When energy conservation became a big issue at the time of the oil crisis, people naturally began to study amorphous transformers. For power companies, such transformers would reduce their cost, and daily reduction in cost meant that much more profit to the company.

Amorphous alloys are, however, much more expensive than silicon steel plates. While more study is needed to determine the cost effectiveness of using amorphous alloys, it is extremely likely that amorphous prices will come down

in the future. On the other hand, since amorphous alloys are by nature an unstable material, we do not yet know whether amorphous transformers can stand a prolonged use of, say, 30 or 40 years. Because these are new materials, some unexpected problems may occur. Under these circumstances, the study and application of amorphous alloys is motivated by a strong desire to make profits by reducing costs.

The power industry in the United States is extremely competitive, with many private companies competing. Naturally, all of these companies are cost conscious, a fact which did not escape the attention of people at Allied, a manufacturer of amorphous alloys. In order to develop any new material, its application must also be developed. Even if a new material has many special applications, and these applications must have rather extensive added value, for sales and technical services are costly. Otherwise, the venture will not be profitable.

In fact, Allied Corporation devotes 95 percent of its developmental work on amorphous alloys to cultivating extensive added value. In the manufacture of transformers, the company has set up a "development-order" system, so that GE, one of the top electric industry concerns in the United States, is responsible for large transformers and Westinghouse for smaller models. Through the Electric Power Research Institute (EPRI), which is comprised of 98 power companies, Allied has distributed 1,000 transformers to be used by member companies. Some other power companies, it is said, have ordered amorphous transformers on a trial basis. Allied can now manufacture 10cm wide amorphous alloys at the rate of several ten thousand tons a year.

In contrast to all this, in Japan nine power companies hold regional monopolies, and all share the notion that their responsibility is to provide a stable supply of power to customers. The cost of power cannot be determined by one company: the agreement and consensus of the government and the Diet are required. Power companies are not sensitive to such items as cost and profit. Furthermore, each power company has its own supplier of transformers, so that Tokyo Electric Company Ltd. is supplied by Takaoka Electric Mfg. Co., Ltd., Chubu Electric Power Inc. by Aichi Seisakusho. Finally, the price of a transformer is agreed upon between the user and the supplier in such a way that neither side "suffers any loss."

In Japan, therefore, transformer manufacturers have little incentive to produce new products. Understandably, they are not interested in new products whose performance they do not fully understand. They will, instead, have the Central Electric Power Research Institute study a new product and be prepared to use it whenever circumstances warrant, although they may wait for results obtained by American users before they actually decide to use it. On top of this, the Japanese manufacturers must deal with troublesome patent rights. With big drops in oil prices minimizing the economic merit of conserving energy, it is only natural that Japanese manufacturers of amorphous alloys, working as they are within the industrial structure described above, have become more and more passive.

Even in Japan, the transformer market is certainly important for it holds the key to any successful establishment of an amorphous alloy venture. But we must realize that the development of such a market will take time.

Electronics and Other Markets

Under these circumstances, the manufacturers of amorphous alloys in Japan are beginning to develop new technologies and open up new markets. Some of the major new trends in this area are as follows:

1. The Electronics Market

The market second only to the power industry is the electronics market. In this area, competition is severe and new products appear relentlessly. For example, because of their superior magnetic properties, amorphous alloys are used in the magnetic heads of audio and video taperecorders. An amorphous magnetic head can reduce the friction noise arising from the contact between the tape and the head, and can also minimize any power loss. TDK, which has been producing magnetic heads for export under license from Allied, is now manufacturing semi-finished "cores" for export; the "cores," as of this March, are being mass produced by Mitsumi Electric Co. Ltd. Other head manufacturers in Japan include Victor Company of Japan, Ltd., and Alpine Corporation.

Products under development include an optical magnetic disk and a magnetic sensor that use a vertical magnetic film made of rare-earth and transitional metal amorphous alloys; and a magnetic bubble memory for computers. In comparison to the characteristics of the markets in the United States, there is a problem in Japan that quality products do not necessarily lead directly to price margin.

2. Thin Film Coating

Amorphous alloys are extremely hard; they resist wear and, resist corrosion extremely well. Researchers have begun to improve the quality of materials such as steel by vaporizing a thin film of amorphous alloy on the surface of these materials. Donen and Mitsui Engineering and Shipbuilding Co. Ltd., for example, have developed a way to apply a film of amorphous alloys to prevent corrosion in nuclear fuel recycling plants. An attempt has been made, also, to apply a coat of amorphous foil to the exterior of a building (Toda Construction Co. Ltd. and Tsukuba University).

3. Manufacture of Bulk Amorphous Alloys

To expand the application of amorphous alloys, it is desirable that they be available in bulk form. Professor Masumoto of Tohoku University and Riken Kogyo have developed a method to do so by manufacturing amorphous powder and applying pressure to mold the powder into desired shapes. They have also developed a way to join bulk amorphous metals.

4. Sporting Goods

Because sporting goods, depending on their performance and quality, can be expensive, many new materials tend to be applied here first. In the case of amorphous alloys, we have "amorphous metal shaft golf clubs" (Japan Dunlop Co., Ltd. and Sumitomo Gomu Kogyo).

5. Others

Sanki Engineering Co. Ltd. has begun the commercialization of plating amorphous metals developed by the venture business firm, Delta Research (Co., Ltd.).

It is said that plated products can be easily turned into wires and strips, and that they can be used as electromagnetic shields.

As we have seen, amorphous alloys are being used in new fields. Whether any one of these new applications can lead immediately to big ventures is a question. The case of amorphous alloys illustrates the point that, while any business requires a firm basis, it is still important to understand the market well and study the patent rights before the fact.

9711/12859
CSO: 4306/3097

NUCLEAR DEVELOPMENT

CHANGES OF REGULATIONS FOR NUCLEAR OPERATIONS ANNOUNCED

Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 25 Sep 86 p 2

Expanded PNC Operations Envisioned
Clarification of Technological Transfer Operations
Expenditures Possible for Joint Government-private Operations

[Text] The Science and Technology Agency (STA) announced that it will present to the next regular session of the Diet a bill to enact a law governing the Power Reactor and Nuclear Fuel Development Corporation (PNC) aimed at expanding its operations and equipping it. The bill contains three basic points: 1. to settle technology transfers to the private sector, 2. to clarify the research and development of the handling and processing of radioactive waste materials, and 3. to make it possible for PNC to contribute money to joint government-private operations. STA will begin basic coordination in the future with the Ministry of International Trade and Industry (MITI), the electric power industry, and others.

The current PNC Act, which regulated the establishment of the PNC, was promulgated in July 1967; it absorbed the Nuclear Fuel Public Corporation and brought into being PNC as a general development organization, which brought under one roof the development of nuclear fuels and, for the first time, the development of new types of reactors.

Until now, Article 23 (Scope of Operations) of the act has provided the basis for all operations: 1. research and development into the fast breeder reactor (FBR) and the advanced thermal reactor (ATR); 2. the reprocessing of spent nuclear fuel; 3. the prospecting, mining, and concentration of ore for nuclear fuel; and 4. operations incidental to any of these operations.

Under recent conditions, the national research and development projects promoted primarily by PNC look forward to the "point at which practical operations could be achieved, all the while working for the verification of technologies on the practical scale and the establishment of verifiable and economical perspectives" (the point of transition to practical application). PNC has already furthered technical development under which technical transfers have taken place smoothly to the Japan Nuclear Fuel Service Company in the area of reprocessing, to the Japan Nuclear Fuel Manufacturing Company for uranium enrichment, and to Electrical Power Development Company in the ATR field.

The present revision, the first revision of the law, is designed to establish technological transfers and to make it possible to simplify the procedure under the old law, since that required the approval of the prime minister on a case-by-case basis as these transfers in their operational scope had not been spelled out previously.

In addition, the revision will define as operations the research and development of the technologies for the handling and processing of spent nuclear fuel, which from a legal standpoint have heretofore been carried out as ancillary operations to reprocessing.

Recently, as PNC's role related to technology transfers has been debated, one of the chief focal points of the revision of the act has been to consider allowing PNC to contribute funds to joint government-private operations.

STA has been trying to carry our operations with the government and private sector working together using the technologies under PNC oversight, and the agency has been receiving these technologies as the finished products of research and development. But consideration is being given to PNC-built facilities or those it will build in the future as "expenditures on real plants," rather than provide cash. In the immediate future people are thinking about such projects as the manufacture of mixed oxides of uranium and plutonium and the conversion into uranium hexaflouride of uranium recovered from reprocessed fuel.

12685/12781
CSO: 4306/2011

NUCLEAR DEVELOPMENT

NUCLEAR FUEL CYCLE PROJECT IN AOMORI DISCUSSED

Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 25 Sep 86 p 2

[Text] At a meeting of their directors on 18 September, the Japan Nuclear Fuel Service and the Japan Nuclear Fuel Manufacturing Company decided to form the "Mutsu Ogawahara Nuclear Fuel Operations Company, Ltd.," in a third-sector formula composed of the Japan Nuclear Fuel Service, the Japan Nuclear Fuel Manufacturing Corporation, Aomori Prefecture, and Aomori Rokkasho Mura. This was done in order to undertake the comprehensive expansion of associated operations accompanying the construction and operation of the three nuclear fuel cycle facilities to be established in Rokkasho Mura in Aomori.

The new company is based on a cooperative siting agreement made in 1985 between the two firms, on the one hand, and Aomori Prefecture and Rokkasho Mura, on the other, and aims at such goals as basic planning from the point of view of regional promotion and the launching of companies with stable employment.

Preparations for the establishment of the new firm have been progressing, aiming at March 1987 in Rokkasho Mura; each of the four partners contributed 25 percent of the capital, with capitalization at the time of founding being 10 million yen (about $250,000).

The principal parts of the operation are: 1. the maintenance and operation of the facility and the administrative supplements; 2. the washing of operational garments used within the radioactive areas; 3. preparation within the facility for snow removal and garbage disposal; 4. management by concession of the mess facility; 5. procurement of supplies and items to be used in operations; and 6. other ancillary functions. These exclude such items as the security required for specialization due to the handling of nuclear fuel materials and the transport operations undertaken by electric power companies.

For the first fiscal year the number of employees will be around 20 people and the annual business will be about 50 million yen, but at the time of the start of operations, the number of employees is expected to increase to around 200 and the annual income to 500-600 million yen.

The organizational structure will be determined after the founders' meeting in October.

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CSO: 4306/2011

FBR SAFETY PLANS DISCUSSED

Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 25 Sep 86 p 2

[Text] On 18 September the Nuclear Energy Safety Commission decided on "research into the safety of the fast breeder reactor" (for 1987-90) for the annual plan for safety research on nuclear energy facilities, etc.

The annual plan for research into the safety of the fast breeder reactor was established last year for the first time; the current plan was redefined in a new way so that it will run through 1990.

Research and development of the FBR "Monju" were not included under the current plan; the objective is basic research into the next generation of large-scale reactors. In achieving this plan, the commission has skipped research on the safety of light-water reactors and has undertaken safety research on the FBR itself, carrying out an investigation of such issues as 1. deep-layer protection, 2. classification of criticality, 3. multi-layered walls, and 4. severe accidents.

The goal is to create appropriate technical safety standards for safety planning and the establishment of methods of evaluation. In addition, in responding to ways of thinking about deep-layer protection, the commission is working at carrying out research on preventing the development of emergency situations (on level 1), research on preventing the spread of an emergency situation (on level 2), and research on preventing the extraordinary release of radioactive materials (on level 3).

In order to assess the margins of safety, in the area of safety research concerned with a severe accident, they are carrying out research on such topics as abnormal transient with scram (ATWS), functional loss of the heat removal system (LOHRS), and post accident heat removal (PAHR).

In the realization of the plans, the reactor and nuclear fuel research group is primarily in charge, but there are also plans calling for them to rebuild the Japan Material Test Reactor of the Japan Atomic Energy Laboratory (JMTR) and install a sodium loop, and then carry out research on the volumes released and the chemical configurations of fissionable particles (FP) that would leak into the sodium cooling medium from the fuel in case of an accident or unusual operation.

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CSO: 4306/2011

COMPETITION FOR NEW MEDIA CONTROL DISCUSSED

Tokyo ZAIKAI TEMBO in Japanese Aug 86 pp 66-76

[Article by Shiro Kamizono: "Strategies of Ministry of Posts and Telecommunications and MITI Vying for Leadership in Telecommunications Field and of Other Ministries; Other Agencies Edging in Between"]

[Text] It is said that new media are the "black ships" to Kasumigaseki. Under the situation of a global economic stagnation, only the new media related industries have unlimited growth potential. And, their competent government agency, the Ministry of Posts and Telecommunications, has thus far been belittled. The orderly jurisdictions of various ministries and agencies have begun to shift. While MITI and the Ministry of Finance, which have the self-confidence of leading government agencies, desperately defend their own interests on the one hand, the Ministry of Construction and the Ministry of Transport also send out propaganda involving new policy measures in an attitude of "not to be outdone." However, this "civil war" with the black ships as momentum is a little overheated; private enterprises in the position of asking for government guidance are having their worries doubled or tripled. The leadership struggle over new media among various ministries and agencies increasingly intensifies.

Ministry of Posts and Telecommunications Becomes Preeminant Government Agency Through Communications Liberalization

The government agency now most alive with enthusiasm in Kasumigaseki is the Ministry of Posts and Telecommunications [MPT]. MPT went by the name of "mail carrier" until a little while ago. It was in the position of crude government agency in charge of worksite operations supervising post offices handling such works as collection and delivery of mail, postal insurance, and postal saving. With the rapid progress of new media, however, the telecommunications field under the jurisdiction of MPT has become the most important medium at this time. This ministry, exercising all supervisory authority, including the right to approve and license, has risen to a position as preeminent government agency in one leap. Young officials of this ministry are assertive, saying that, "We are dealing with work that decides the future of Japan for the century to come. As government officials, we must realize the worth of this work, mustn't we?"

Not only are they enthusiastic, but they have made steady preparations aiming at the evolution of their ministry into a policy-making government agency. MPT took the initiative in pushing the communications liberalization with MITI and the United States as opponents. In policy making aiming at an advanced information society, it set up advisory panels and symposiums with such energy that the other ministries and agencies wondered "Can this be MPT?" Further, when the "introduction of private resources" became a policy theme, it inaugurated an international telecommunications basic research institute by inviting communications-related enterprises, and went so far as to form a committee for the private-sector independent standards for telecommunications equipment.

While having inaugurated Japan's largest private business "Nippon Telegraph and Telephone Corp." (NTT) by privatizing the Nippon Telegraph and Telephone Public Corp. on one hand, MPT immediately launched NCC (new common carrier = newly participating Type A telecommunications enterpriser) to oppose NTT, thereby checking NTT's advancement, and at the same time it shrewdly put MPT "old boys" in NCC. These were done so skillfully that even such "advanced government agencies" as the Ministry of Finance and MITI are put to shame. Through various types of advisory panels and symposiums, the "pro-MPT" human linkage of economic circles and academic societies has also been strengthened. MPT's eagerness appears to know no limits, saying that "the advanced information society is a national goal, but it is also a global goal. There is no model nation wherever we may look in the world. To put it strongly, we are to make history."

MPT Outrivals MITI in VAN War

However, although there was some luck involved, MPT's rapid rise in position was not merely a stroke of fortune. The proverb says that a tall tree catches much wind, and MPT has had a bureaucratic advantage in staking keen competitions with other ministries and agencies, particularly with MITI whose jurisdictions often overlap with those of MPT.

The first case wherein the MPT-MITI struggle drew local attention was the so-called "VAN war" in the spring of 1984. At the start of a new communications business called VAN (value-added network), MPT was adamant about "foreign capital restriction" and "license system" concerning large-scale VAN (special Type B). Regarding the "foreign capital restriction," MPT says that the United States, where the VAN market came into use in 1972, is a few steps ahead of Japan in opening VAN in technical and financial aspects. For this reason, it says, it plans to set up certain obstacles to the advance into Japan by powerful foreign-capital VAN until Japan's VAN business becomes fully competitive as it was at the time of the rise of the automobile industry. As for the "license system," on the other hand, it was the contention of MPT that in view of the latent strength of influence of VAN on the industrial society, the competent authorities should take the leadership for securing fairness and promoting sound growth.

Against this, MITI, partly because of a fear that communications equipment makers under its jurisdiction could not fully grow under MPT's strong restriction, conflicted head-on with MPT, calling for an overall liberalization of

VAN business. MITI has a strong opinion that "it is we that have grown the high-tech information equipment industries, including the computer." Thus, there are those who were displeased at the intrusion of "latecomer" MPT in an attitude claiming, "We are the competent government agency over the information industry."

For instance, in an interim report of the information industry subcommittee of the Industrial Structure Deliberation Council, which it received in late 1983, MITI "had the subcommittee say" that "in order for new media to develop strongly the freedom of participation, the freedom of business activity, and the freedom of utilization should be secured. To that end, other than the basic transmission services such as telephone, either VAN or CATV business should all be liberalized," thereby checking MPT, which pushes policy making toward the full-scale realization of rhe new media age, as if to say, "Do not be too eager, but leave the matter to the independence of the industry."

Finally, the VAN war was committed to reconciliation by the Liberal Democratic Party [LDP] with the two ministries sticking fast to their respective positions. As the result, the "foreign capital restriction" was removed and the "license system" for general Type B communications enterprisers was modified to "report system." However, since "registration system" was introduced with regard to large-scale VAN, MPT was certified as the competent government agency over VAN. Thus, the war ended in MITI's defeat. The Federation of Economic Organizations, MITI's last resort, announced its view showing understanding of the MPT side. "Arrogant" MITI also failed to lay the groundwork for its position. But it was persistently rumored in the neighborhood of Kasumigaseki that "it was the difference in the political influence on the LDP that decided the issue." At that time, MPT already kept a firm hand on the Tanaka faction, the largest faction in the LDP, and was steadily strengthening its position toward rapid progress.

There is the "second act" in this VAN war. Concerning Type B telecommunications businesses' standard for "partition" between the special Type B of the registration system covering many and unspecified enterprises and the general Type B to be completely opened as a matter of fact, MPT and MITI were again opposed to each other.

MPT Policy's Eye-Catching "Teletopia Concept"

To become a little technical, whereas MPT showed a plan to categorize more than 500 circuits in terms of 1,200 bits per second in transmission speed as "special," MITI urged a raised standard, saying that under this standard, when digital circuits spread, "general" also would mostly be "upgraded" to "special" and dragged into MPT's "control" before long. The United States, calling for a complete liberalization, also sided with MITI and applied "pressure" to MPT, but MPT overcame MITI and the United States by a compromise plan that "it will not change the standard itself, but will ease the way of counting the number of circuits only in the case of digital circuits." A key official of the Ministry of Foreign Affairs, for instance, was surprised at the state of MPT's rapid growth, saying that "speaking of MPT, it is understood to have been a complete innocent concerning diplomatic negotiations, but it has changed very much.

While having troubles both at home and abroad such as that MITI is pro-United States, it solved the Japan-U.S. communications friction problem somehow or other, and thus it seems to have gained self-confidence of late." After all, the second act also ended in MPT's victory; thus it can probably be said that this ministry has consolidated its position as the competent government agency over VAN business.

Incidentally, the starting point of MPT's leap to "stardom" at Kasumigaseki with new media as the jumping off point was probably in May 1980 when it combined the existing Telecommunications Comptroller Office and Communications Policy Section, Minister's Secretariat to establish the "Telecommunications Policy Bureau" that conducts supervision and guidance of the then Nippon Telegraph and Telephone Public Corp. and Kokusai Denshin Denwa Co., in addition to drafting the policy for new communications such as CAPTAIN system and video response system.

Thereafter, this ministry was to spell out new policy measures in succession with this bureau as the center. There is an inside story concerning the name of this bureau. It is said that at first, there was a plan to name it "Denkitsushin Sangyo Seisaku-Kyoku (Telecommunications Industry Policy Bureau)" in that it would cover the overall communications industries. However, for the reason that when shortened, this name becomes "Tsusankyoku," which might totally irritate MITI [MITI's nickname in Japanese is Tsusansho], this plan reportedly was canceled. This interesting episode almost predicted MPT's competition with MITI, called the "hundred-years war."

According to young MITI officials, "Industrialization of information comes under the jurisdiction of MPT but informationization of industry is our work." Calling this statement understandable but not realistic, this reporter asked again about its meaning. Then, they replied that "considering the case of railroad construction could make it easier to understand."

In other words, it comes to this: The advanced information network making promoted by MPT is just like laying a railroad. It is a great project by itself, but it is only the first step. What comes next is to develop the industry by using that railroad, and since this is the industrial policy, it comes under MITI's jurisdiction. The work to informationize firms and households and distant communities by utilizing the network laid by MPT just falls on this, and therefore, hereafter it is MITI's turn. Under this situation, it cannot be the case that there is no conflict with the MPT which eagerly considers that "it is we who play the leading part in the advanced information society." In fact, the two ministries are carrying on an endless "interministerial war" also in the urban and community network concepts.

Already in the 1970's, there was a "prehistory" of their feud that when MPT started an experiment of community information network system by the Tama CCIS, MITI opposed this by the Higashi-Ikoma Hi-Ovis. Therefore, when the new media age got into stride in the 1980's, the two ministries escalated their struggle to be "the leading government agency of the advanced information society" by putting the advanced informationization of rural areas to the fore of their policy in the way that when MPT spelled out the Teletopia

(future-type communication model city) concept, MITI also announced the new media community concept.

MPT's Teletopia concept is aimed at promoting the informationization of community, thereby spreading INS all over the country. Concretely, as the first-phase order, MPT in March 1985 designated 20 communities as "model cities" and 14 communities as "improvement promotion communities" throughout the country and had them begin to construct medical, educational, sightseeing, agricultural, distribution, and other information systems by use of CATV, CAPTAIN, etc., to start with.

This included also the inland high-tech industrial city-making concept of the wide city-town-village area in the Suwa district, Nagano ken. It is well known that practical use tests of educational and cultural systems using CATV are being promoted. This ministry is taking such measures as to support the designated communities by government investment and loans and tax privileges to make it easy for them to promote their measures and at the same time, to introduce CATV, videotex, etc., into them on a priority basis.

MITI Also Hammers Out Advanced Informationization Concept of Rural Areas

On the other hand, MITI's new media community concept is "to help each community develop its own advanced information system suited for its characteristics," and in October 1984 MITI designated eight communities, such as Takasaki shi, Gunma ken, as model communities. The designated communities, establishing the enterprising body that becomes the sponsoring organization through a third-sector formula by prefectures, cities, local enterprises, etc., are launching and carrying out plans while asking for the guidance and support of MITI.

Upon giving the guidance, this ministry reorganized the Foundation Visual Information System Development Association having operated Hi-Ovis in Higashi-Ikoma for many years into the Foundation New Media Development Association and assigned it to guidance work from FY 1985. Also, it is conducting studies on the backup in the budgetary field, too, such as subsidies for the industrial relocation promotion expenses, grant-in-aid for the electric power location promotion measures, etc., in addition to loans for the small and medium-sized enterprise information foundation improvement through the government investment and loans and the Smaller Business Finance Corp.

However, whether it is MPT's "Teletopia" or MITI's "new media community," it is difficult for laymen to understand how they differ from each other in contents. It seems that even the local autonomous bodies that applied for the community designation were unable to distinguish between them, and there were several autonomous bodies which applied for both of them.

In the "Port Future 21" project of Yokohama shi, whose motto was taking the lead in the advanced information age, both MPT and MITI designated that city as an "outstanding community." Even the Ministry of Construction, which has the "intelligent city concept" aiming at the strengthening of the urban information function by the laying of advanced information-communication trunk in

addition to road and sewerage improvement, "watched" this city. This being the case, there is even a rumor that an official in charge of the project of that city was thoroughly disgusted, saying, "Since they go to the trouble to designate our city, we have no objection, but vertical jurisdictions of government offices do not work in the computer."

In order to prevent elation over the overheating of an MPT-MITI "locality grab operations," prompting local autonomous bodies to excessive investment, the Ministry of Home Affairs, for instance, began making a "local information foundation improvement general plan" late in May; the actual harm of the interministerial war also began to worry some.

Probably partly for this reason, MPT, beginning this year, designated 19 communities such as Akita shi, Hachioji shi, and Kitakyushu shi as the second-phase model cities of the Teletopia concept. However, it solidified a policy of not inviting applications for third-phase designation, saying that, "since the method of promoting community development by new media appears to have taken root, it is necessary to stress the introduction and improvement of new media in the already designated communities."

Thus it is expected that the final number of model cities including those added by the second-phase designation will include about 60 communities. A situation has come about where the leadership struggle for the advanced informationization between MPT and MITI in rural areas also is likely to head for cooling down at long last.

On the other hand, however, MPT has begun making an Asian version of INS by approaching China, the Republic of Korea, the ASEAN countries, etc., and since MITI is greatly interested in this, there are also indications that more trouble is likely to take place with foreign countries as the stage this time.

The recent confrontation between MPT and MITI often composes a picture of "an old store" MITI protecting its traditional interests against the offensive of "rising dragon" MPT. What showed it straightforwardly was the strife last summer over the establishment of "broadcast technology development council."

Saying that "now that the new media age has gotten into stride, in order to develop new broadcast technologies suited for this, close cooperation between MPT and broadcast-related equipment makers for broadcast business companies is essential," MPT decided to newly establish a "broadcast technology development council," which includes all interests down to electronic machinery makers, and approached each enterprise. Since the new media related business is regarded as the largest growing field in the future, among the promoters of this council were President Katsushige Mita of Hitachi, Ltd., and the presidents of Matsushita Electric Industrial Co., Toshiba Corp., NEC Corp., Mitsubishi Electric Corp., Sony Corp., Sharp Corp., Sanyo Electric Co., General Corp., Nichiden Home Electronics, Pioneer Electric Corp., and Victor Co., of Japan, totaling 12 large enterprise.

MITI was surprised at this. Originally, the supervision of broadcast communication equipment makers was under MITI's jurisdiction, and there is already the Electronic Industries Association of Japan (600 companies) for the industry as a whole, which is operating in close contact with MITI. The participating members in the new organization of MPT are completely comprised of those of this electronic industries association. MITI voiced opposition to the making of the new organization by MPT in a sharp tone, saying that even if it might not be called "intrusion into our jurisdiction," MPT is "to divide learned circles into two parts by making a second industries association."

Private Firms Worried Over MPT-MITI Mudslinging

Against this, MPT rebuts, "We have not the slightest intention to step into production, distribution and trade friction problems, etc., by making a sort of electronic industries association. We judged that a place of coordination among makers is necessary for developing new broadcast systems such as high-definition television and stereo broadcast of AM; therefore, MITI's criticism is irrelevant." It retorts to MITI, "MITI is childish; for instance, it applies pressure to makers so not to participate from an absurd consciousness of jurisdiction. It should consider the future of the country from a higher point of view."

MITI also does not yield. It assumes a defiant attitude, saying that, as before, broadcast system and radio utilization have been under MPT and equipment and receiver have been under MITI. This is clarified also in the disposition act of the government offices, and therefore, MPT's claim is nothing but a sophism."

Furthermore, there are some people who feel that, "behind MPT's bulldozing its way is an aim to utilize private sector money instead of NTT money, which it had planned to use, for funds for the central technical research institute MPT plans to newly establish because it is unable to count on the latter."

Concerned businesses are worried over the confrontation between the two ministries, which has come to assume a mudslinging aspect. For fear of being caught in the crossfire by making unwise remarks, all related businesses refrain from comment. However, a business executive, while saying, "Although I hesitate to say this openly," reveals that "should it be the problem of the industrial groups, it is enough for us to get ready for a certain degree of investment increases while keeping an equal distance from the two. We are at a loss in the problem of making unified and technical standards.

The "communications unified standards dispute" also started with the "offensive" of MPT. Prior to the liberalization of telecommunications business in April last year, this ministry worked out a draft plan for the submission of bills, saying that "when liberalization comes, it is certain that diversified telecommunications service businesses will come into being in the form of meeting various communications demands. In order to back up the realization of an advanced information society while avoiding great confusion, it is necessary to improve the foundation for the advancement of telecommunications."

What was most noticeable was the introduction of the unified standards "JUST," which this ministry recommends with the communications system as the object.

JUST is short for the Japanese Unified Standards for Telecommunications, and it is such that should makers manufacture their products in accordance with these standards, the overall communications networks would function without hindrance.

However, MITI, which already established the unified standards for communications equipment in JIS, was pushing also the JIS standardization of CCNP (computer communication network protocol), a "communication system" to link between different types of computers. Thus it raised an objection once again that "MPT's JUST is an unnecessary duplication of JIS."

To this, MPT says that "JUST is based on the recommendation of CCITT (International Telegraph and Telephone Consultative Committee) that established the international standards for communications systems, so that it holds good internationally, too." Thus, expediting the establishment of new JUST by creating the "JUST Promotion Office" in the Technical Development Planning Section, Telecommunications Policy Bureau, for instance, MPT appears not to care about MITI's criticism. Not only that, as if to say "the just cause is on our side," MPT has extended its activities even to the unified standards for computer protocol (communications procedures) and facsimile, Japanese telex, telewriting (picture drawing communication system), electronic mail, etc.

Last summer, moreover, as if to "challenge" MITI's JIS itself, MPT, serving itself as promoter, led to the establishment of the "Telegraph and Telephone technical Committee" (TTC for short) which works out the telecommunications technical standards on a private basis. This was copied after the U.S. T1 Committee, and we made it "only in response to a proposal made from the U.S. side at the Japan-U.S. communications conference," explained this ministry.

In the United States, all technical standards are made by private-sector committees. In the same way that communications field standards are made by the T1 Committee, so are the information processing equipment standards made by the X3 Committee; as many as over 200 committees are organized. The Japanese makers branching out into the United States also are taking part in such committees and acquiring information therein.

It is true that the United States, which considers Japan's technical standards for communications equipment constitute one of the nontariff barriers, was demanding that Japan drastically ease these standards and at the same time was calling for Japan's adoption of the committee system that is operated in full view of the people like it is in the United States by having foreign makers also participating in setting standards. Since under the circumstances where the trade friction problem rages, it is a supreme order for Japan to keep government intervention as low as possible, MPT's measures can even be said to be well taken. However, it is MITI that is not satisfied.

This is because if this sort of setting of standards by private-sector committees becomes the general trend, the JIS system of setting technical standards with large state participation might be set on a shaky foundation. MITI asserts that "JIS is not compulsory standards," but since public organizations are obligated to use the JIS-standardized products, JIS is substantially compulsive. To have or not to have the JIS system would completely change the strength of influence of MITI. Ostensibly, MITI exhibits a wait-and-see attitude, but reportedly it is putting "pressure" on makers behind the scenes to prevent them from positively joining TTC, and possibly for this reason, it appears that the move of TTC too is just a little short of active.

Ministries and Agencies Oppose Each Other Also in Safety Standards in Communications

Also, with the cable fire in Setagaya, Tokyo the year before last providing momentum, interests in safety measures for computer systems have increased and a cry for the making of information-communication system safety standards by the government has intensified. The recent sharp increases of computer system related crimes such as unlawful data input, computer destruction, and program alteration are giving impetus to such moves. Thus 11 ministries and agencies concerned are continuing deliberations by creating a liaison council, but here again, the MPT-MITI confrontation came to the fore and unification work is facing rough going.

MPT's safety standards lay stress on the safety and reliability of communications circuit and network, and with regard to such matters as security of communications, data protection and backup system in preparation for breakdown, the Telecommunications Technology Deliberation Council (advisory organ to MPT) is now finalizing plans.

On the other hand, MITI's standards are those for the computer system itself and present considerable differences, incorporating such measures as physical protection of computer systems from destruction by fire, earthquake, or intruder, or encoding of file and transfer technology and establishment of system inspection setup.

The Ministry of Finance also has started to establish safety standards with the aim narrowed to monetary facilities as banks and securities, life and nonlife insurance companies at the center of the Foundation Financial Information System; the National Police Agency, with a view to preventing crimes and accidents, is conducting studies on standards by establishing the Computer System Safety Measures Office in the agency. The Cabinet Counsellor's Office is maneuvering for the settlement of the matter as mediator. However, MPT, which dislikes restrictions admits two or more sets of safety standards, saying that "safety standards establishment is something like an appeal to business to focus their attention on the safety measures. Even if it should be the case that while our ministry appeals to businesses from the standpoint of preservation of network on one hand, MITI appeals to them with a view to protecting computers, there could be no particular problem.

Be it the unified standards, technical standards, or safety standards, calculations of ministries and agencies are jumbled together, and these are still unlikely to be easily unified. Private businesses which are bound by these regulations are embarrassed, and if they are not careful, they will have to pay attention to the standards of various government offices.

The aforementioned business executive said in a resentful tone that, "The government offices insist on the introduction of private resources only in case of a concept conforming to their own policy; but should they really want to increase private resources, we want them to devote themselves wholeheartedly to being a small government by reducing regulations to the greatest possible extent."

Opposition to expansion by MPT is not limited to MITI alone; there was fierce give and take also with the Ministry of Construction [MC] over the road occupation licensing for CATV. MPT is devoting all its energies to the dissemination of urban-type two-way CATV by positioning it as the standard-bearer of new media, citing it as one of the main pillars in the Teletopia concept, for instance. That it gave CATV business licenses one after another first to International Cable Network (ICN), Japan's first such business, and then to Tokyu Infonet, and Central Cable Television, also argued for accelerating the dissemination of CATV.

However, when ICN and Central applied to MC, Tokyo to, and Nagoya shi, respectively, for the road occupation licensing for cable laying from the summer to the autumn the year before last, the problem of underground cables suddenly came out. In other words, MC's administrative guidance stated that it can be assumed that future cables will be underground and reserve funds should be accumulated to deal with street beautification and security of new CATV cables. The two companies which planned their CATV business in the system of joint use of electric poles, were greatly confused and asked MPT for mediation. Underground cables cost about ¥40 billion in case of a CATV business covering 40,000 households, requiring assets of as much as 10 times those for above ground cables. It is said that CATV cannot become a paying business for at least 5 to 6 years from the start, and yet they are required to accumulate a large reserve fund. Under this situation, their business could hardly pay, they say.

MC and MPT Rival Each Other in Urban-Type CATV

MPT promptly started consultations with MC. However, MC was uncooperative, saying that, "MPT ought to have talked with us before it gave CATV a business license, but it acted arbitrarily on its own authority"; MC did not give a favorable reply. From the CATV industry came loud criticism that "MPT lacks competency as the party concerned in that it cannot even coordinate with MC."

Last summer, therefore, MPT decided to introduce a "conciliation bill" aimed at the simplification and explicit security of administrative procedures in order that CATV business can be started smoothly as in the case of electronic computer business and communications business. MPT pressed MC for cooperation.

In the background of MPT's having ventured to promote its strong measures was the completion of various advantageous environments. For instance, since urban-type CATV calls for large-scale equipment investment due to such factors as that the number of lead-in terminals amounts to more than 10,000 and the repeater amplifier has a two-way communications function, it contributes to the expansion of domestic demand, the most important policy of the Nakasone cabinet. Since this system will become a large user of the U.S.-made communications satellite scheduled to start operating from the spring of 1988, the United States also has a great interest in the problem of road occupation.

In response to this, in late September MC issued its Road Bureau Chief notification and simplified the office work procedures for the road occupation licensing. However, since it had ill feeling toward the high-handed MPT and was proud of its position as road administrator, this ministry rejected MPT's demand. It said that urban-type CATV operators of newly started businesses have an obligation to conduct prior consultations as in the past until the business plan is established and the administration side also becomes capable of taking measures in line with it. The reason for this is: "MPT demands that CATV be handled in the same way as electric power and Type A telecommunications businesses, but is it proper for MPT to call for putting it in the same category with public undertakings without revealing even what programs it will put on the air? If it broadcasts programs running against public order and morals, we cannot afford to let it use the road that is a public property."

To this, MPT and the CATV industry replied, saying that MC merely complicated the procedures, and the confrontation escalated. Thus the LDP proposed mediation, and as MC finally showed a new notification draft complying with MPT's demand, this problem also was resolved toward the end of November last year. However, MPT says that hereafter, while watching whether MC will carry out its policy as planned on one hand, they want to have separate talks with MC on settlement of the road occupation problem. Thus the possibility of the feud between the two ministries continuing remains.

In CATV, although not so conspicuous as MPT and MC that had a showy "fight" with each other, the Agency for Cultural Affairs also bears a part. It is promoting the making of rules for the copyright of on-air programs, and has inaugurated a "research and study conference" of a group of experts, thereby setting about to complete the calculation standards for the rental fee of programs, etc.

As the two ministries of MPT and MC came to terms with each other, CATV business began to move on a full scale at long last, but when movies, television dramas, music programs, are broadcast in large volume by CATV, it is fully conceivable that trouble could occur over their copyright among the authors, performers, and CATV operators. At present, however, such rights as "rebroadcast right" and "reproduction right" given to the general broadcast enterprisers are not granted to CATV operators. Thus "makeshift measures are being taken" for the present in the form of laying before the Diet a Cable Television Broadcast Act revision bill of the contents to skeletonize the approval right of the television stations. Further, since the calculation

standards for the rental fee at the time of purchasing programs from others and putting them on the air also have not yet been completed, it is also necessary to expedite the making of such rules.

Over the new media involving copyright problems, the Agency for cultural Affairs and MITI experienced a heated dispute in 1984. They were opposed to each other over the legal protection of computer software and programs, which was not in existence theretofore. The Agency for Cultural Affairs maintained that it should be met by the revision of the Copyright Act by applying the idea of the copyright as in the case of literary works, movies, music, whereas MITI insisted that it should have the same industrial right as an invention, and a sort of "program right act" should be newly established. This dispute was settled as MITI withdrew persuaded by the strong assertion of the Agency for Cultural Affairs and the United States. At this time, however, the Agency for Cultural Affairs consulted the Copyright Deliberation Council not only on the computer-related copyright problem but also on the copyright problem relating to such new media as CATV, CAPTAIN, and INS at the same time. This agency has accumulated data since then.

MC and Ministry of Transport Announced Participation in Daini Denden

On the other hand, the National Land Agency also shows an interest in CATV, and started in FY 1985 a survey on the method of introducing two-way CATV into rural areas. This is based on a fear that being an idle onlooker of the advanced informationization proceeding centering on cities would lead to the expansion of the information gap between urban and rural areas and this would further accelerate depopulation. In order to prevent rural areas from being left out of the wave of the advanced informationization, it has decided to conduct research under a 3-year plan on the conditions necessary for the diffusion of new media to rural areas by establishing a study committee comprising men of learning and experience and information-communication interests.

As for the introduction of new media into rural areas, the Ministry of Agriculture, Forestry, and Fisheries is already conducting experiment of MPIS (multipurpose information system) used for community receiving of television and for communications in a system of stretching coaxial cables all over town in such areas as Kokufu cho, Gifu ken as a part of its agricultural improvement project. Since it is cable, its service centers on advanced and two-way utilization of CATV, and recently it has come to broadcast weather forecasts and independently produced programs in addition to community receiving, administrative public relations, and agricultural broadcasts.

On the topic of the urban-type two-way CATV dispute, MC appears to be pressed by MPT, but this ministry also has been hammering out various measures of its own in new media. For instance, it advocated an "information highway concept" to conduct communications business by laying optical-fiber cables along the two expressways between Tokyo and Nagoya and between Nagoya and Kobe, and late in 1984, it inaugurated a new firm "Teleway Japan" for that purpose and began construction work.

Further, in order to expand this trunk communications network to urban areas, it continuously announced an "urban teleway concept" to lay optical-fiber cables also along the Tokyo expressway and Osaka-Kobe expressway, and as an organization to study new businesses attendant upon this concept, it established the "Urban Teleway Planning Promotion Council" in the Foundation Road New Industry Development Organization. This ministry says that in the future, it wants to establish a new company and lease communications circuits to CATV operators on one hand and to have connection also with such communications systems as telephone and facsimile. This ministry expects that in either concept, since the existing roads are effectively used, cable laying at low cost becomes possible, and thus these concepts can become fully competitive as one of Daini Denden.

On the other hand, the Ministry of Transport also established Japan Telecom of the Japanese National Railways group to use railway tracks instead of roads of MC, and similarly announced its participation in Daini Denden.

Like this, MITI, MC, and the Ministry of Transport are fighting the power expansion battle over new media in confusion centering around MPT; but the Ministry of Finance, a government agency among government agencies, keeps silent. One wonders if it completely ignores the matter, but it is not always the case. It cannot be denied that its start was late, but this ministry is eagerly watching for a chance to win a come-from-behind victory by a single shot, using the weapon of "financial VAN concept." The financial VAN concept is to establish a special VAN enterprise "backed up" by the Ministry of Finance, and by linking this with banks and firms, to make service network to transmit various types of information to banks and firms. Even now, the national bank data communication system is operating as a sort of financial VAN, and NTT serves as, so to speak, a VAN firm. Said concept envisions that this new company will undertake this business instead of NTT and its coverage also will be expanded from about 700 participating banking facilities at present to the overall banking facilities.

Further, although the national bank data communication system handles only the exchange settlement, the new financial VAN is planned to be a comprehensive VAN to handle "information system services" as well. In other words, connections to the computers of customer firms of respective banking facilities are planned thereby making it possible for these firms to acquire instantly financial information such as the state of incoming or outgoing money and bank balances by using the financial VAN. Not only that, it is said that consulting information service concerning management and financial affairs can also be received. Should this materialize, the Ministry of Finance would be able to grasp not only the flow of money but also the overall economic transactions through its backing financial VAN firm. It becomes possible for this ministry to rise to the vanguard of the advanced information economy at a stroke on the strength of financial VAN.

Ministry of Finance and Major City Banks Antogonistic Over Financial VAN

However, even this grand concept of the Ministry of Finance, to which the Long-Term Credit Bank of Japan, Ltd., group and the Nippon Trust & Banking Co. group,

the Central Cooperative Bank for Agriculture and Forestry, gave consent, came to a deadlock because the major city bank group rejected it and set about to make a joint CMS (cash management service) center independently. A discontented city bank executive, saying that "Since the Ministry of Finance's VAN forces all banking facilities to act in concert with each other, the more backward ones gain an advantage. We should like to ask this ministry if it still intends to maintain the convoy system." He says that this ministry is too anachronistic at this time when rapid progress of monetary liberalization is predicted and it is feared that some banking facilities may go bankrupt like those in the United States.

The Ministry of Finance also has its own claims. It says that making the CMS center in each banking facility would result in a large duplicated investment in the monetary world as a whole and would thus weaken the physical strength of the overall monetary world, that because of the progress of financial informationization, the danger of computer-related crimes and accidents is increasing and the infringement of users' privacy is also feared. Thus, the establishment of safety standards is an urgent theme. To leave either of these matters entirely to independent banking facilities would only increase the confusion; therefore, the matter should be promoted under the leadership of the Ministry of Finance.

The Ministry of Finance and the major city banks remain hostile; and although they maintain ostensibly cooperative relations, the break between them could become clear by a sort of accident. Last summer, for instance, when a VAN firm of the Sumitomo Bank group applied for license of special Type B (large-scale VAN), MPT readily granted it, but the Ministry of Finance "interfered," saying, "VAN service has the possibility of exceeding the sphere of business that the bank-related firms can handle."

Since it was also the case that this ministry called nothing to account when the bank-group firms started a small and medium-sized enterprise VAN the year before last, there are some people who apprehend that the "interference" by the Ministry of Finance might possibly be revenge to the rejection by the city banks against the financial VAN concept led by the Ministry of Finance. On the other hand, there are also views that it is possibly a demonstration to MPT by the Ministry of Finance that even in the case of communications and new media related businesses, jurisdiction over the banks is in the Ministry of Finance to the last.

After a lapse of over 1 year since the liberalization of telecommunications business, the new media finally began to take root in the industrial world on a full scale. Following this, various ministries and agencies fought a heated "interministerial war" for securing their interests involving new media. However, in their eagerness to quarrel over their jurisdictions, it seems that there has recently been an increasing trend to involve even the private firms in their strife.

Originally, government offices were to support and facilitate private economic operations, but the reverse is by no means the case. The new media are a small number of promising stars with a rosy future. It is believed that all ministries and agencies concerned should carefully foster related industries from the viewpoint of everyone's best interests.

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