UNITED STATES PATENT POLICIES FOR GOVERNMENT-SUPPORTED RESEARCH*

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This paper will review the issue of United States patent policy as it concerns inventions made under federal government funding of universities and similar non-profit organizations. The starting point will be to specify what objectives one is seeking to accomplish through this component of federal patent policy.

The Patent and Trademark Amendments of 1980 (P.L. 96-517), that was recently passed, establishes uniform federal policies with respect to inventions made by non-profit organizations, universities, and small businesses under government-supported research and development programs. Prior to the passing of this bill, federal government agencies sometimes took title to the patented inventions made under their grants and contracts (the so-called "title policy"), whereas in other cases they let the contractor retain any resulting patents and insisted only upon a

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royalty-free license to use the underlying inventions for governmental purposes. Under this latter "license" policy, the contractor in effect has an exclusive right to the civilian market exploitation of its inventions. Under the "title policy," on the other hand, it lacks such assurance. P.L. 96-517 moves the United States government firmly toward a "license" policy.

The primary objectives of the bill, as repeatedly stated in hearings and other discussions, are to promote industry development and commercialization of inventions made with government support and to promote increased cooperation and collaboration between the non-profit and commercial sectors. Ultimately, it has been stated that this improvement in government patent policy will add to greater productivity in the United States, provide new jobs, create economic growth, foster increased competition, make government research and development contracting more competitive, and stimulate a greater return on the dollars spent each year by the government on its research and development programs.

The question then arises: to what extent will exclusive patent rights further stimulate commercial utilization of these inventions? This paper focuses on the issue of whether this shift in patent policy is likely to positively influence the rate and direction of utilization and commercialization of government-sponsored research in universities. Is the choice of a license over a title approach likely to have any perceptible effect on civilian market utilization of government-supported research in universities?

Several questions will underlie the discussion.

A. Why is university-generated research a source of invention to be developed and commercialized by industry?

B. To what extent are patents an important mechanism to encourage utilization of university inventions in industrial innovation?

C. What are the objectives of P.L. 96-517?

D. What are the likely impacts of the patent reform?

A. Why is University-Generated Research a Source of Inventions to be Developed and Commercialized by Industry?

In the last thirty years, theoreticians of science and technology have shifted from an emphasis on scientific discovery to more comprehensive measures of technological innovation and change. The reason for this shift appears to be mainly acceptance of the view that scientific discovery is only one element, although an important one, in a wide process, and that the output of scientific research influences the nature and direction of technical progress (1).

The process by which technical change occurs includes three stages: invention, innovation, and imitation or diffusion. At the invention stage, the new insights underlying a product or a process are achieved and subjected to preliminary testing. At the innovation stage, the match between technical possibilities and market demand or user needs is recognized and the invention is developed to full-scale production and introduced into the market. In the diffusion or imitation stage, other organizations observe the innovating organization's success and imitate the products or processes.

In addition, the invention and innovation functions are not necessarily located in the same organization. In fact, a large fraction of the ideas or inventions successfully developed and marketed by well-known corporations originated with independent inventors, university laboratories, or other enterprises.

Studies on the origin of DuPont innovations (on innovation in scientific instrumentation, on innovation in pharmaceuticals, and on industrial innovations in general) show that the sources of many innovations are outside the firm which exploits them (2-5). Other studies on textiles, on steel, and on research and

development in England show a correlation between the innovativeness of firms and the extent to which they maintain multiple channels for acquiring knowledge outside the organization (6-8).

The importance of knowledge originating outside innovating organizations has also been documented in studies of the innovative process. The Science Policy Research Unit of the University of Sussex in England analyzed successful versus unsuccessful examples of essentially the same attempts at innovation (9). The measure of external communications strongly differentiated successful from unsuccessful cases for 12 innovations in the field of scientific instrumentation. External communications were less important in predicting the success of chemical process innovations.

Research also indicates that the use of knowledge, external to firms, is influenced by factors on several levels. Among those factors are things such as the professions of the individuals within R & D organizations and their particular tasks; organizational variables that influence flows of information into organizations; and environmental factors, such as the rate of scientific and technical change within the industry of which the organization is a part (10-12).

On environmental factors, most studies concentrate on industries where the state of the art is rapidly changing. More placid environments may lower the demand for knowledge external to organizations (13). Myers and Marquis did find that the sources of information facilitating innovation differ from one industry to another (5). Another study shows that the less routine the environment, the more reliance there is on sources of information external to organizations (12).

In general, the literature provides evidence that external sources together with in-house innovative activities are associated with successful industrial innovation efforts.

External sources of knowledge used in industrial innovation can be characterized in terms of their organizational or insti-

tutional sources, that is other industrial firms, the government, or the university-professional society infrastructure. This provides a three-way categorization of the kinds of influence government science and technology policies have on industrial innovation: (1) government support for university research and its transfer to industry; (2) dissemination of the results of government R & D programs; and (3) government incentives/regulations that influence transfer of knowledge among industrial firms.

For the innovation process to be productive then, knowledge and inventions outside the firm must be generated and transferred to the firms for translation into commerical products and services. Our particular focus is on university-industry transfers.

B. To What Extent are Patents an Important Mechanism to Encourage Utilization of University Inventions in Industrial Innovation?

Many potential avenues have been suggested to enhance the utilization of basic research in industrial innovation. For example, several papers presented here discuss university-industry research consortia and research partnerships.

Allen concluded, after extensive study of R & D organizations, that to improve utilization of research results among technologists, government should pay a good deal more attention to, and make more investment in, person-to-person communication (11). Pavitt's policy recommendations follow a similar direction: person-to person contacts are the essence of effective university-industry collaboration (14). Government has an important role to play as a catalyst or "impresario" in creating the framework within which regular contacts take place between university and industry. Government could establish additional or more effective mechanisms and institutions through which university and industry personnel meet face-to-face.

Several assumptions underlie recommendations, such as Allen's and Pavitt's, about government policy to improve knowledge trans-

fer between the university and industry. First, more university-generated research results are relevant and of potential benefit to the innovation process than are currently being used. Second, no fundamental differences exist between policies toward ownership and transfer of knowledge between the two sectors. Third, non- or under-utilization of research results by industry presents a problem which can be overcome solely by eliminating imperfections in the knowledge transfer mechanisms between the two sectors.

This traditional science policy literature attaches great importance to identification of factors that stimulate or impede scientific and technical knowledge exchange and transfer between universities and industry. The literature presumes, in general, that if imperfections in the knowledge itself or in its mode of delivery can be overcome (i.e., if the data were more timely, higher in quality, more relevant, in the proper form, etc.) then utilization and apllication will automatically follow.

These assumptions began to be increasingly questioned by analyses that pointed out, for example, that "science" and "technology" are different activities that occur within different group settings characterized by distinct organizational patterns, group values, and resource endowments (15).

Wolek and Griffith suggest that government scientific and technical policy recommendations should acknowledge the different "social contexts" within which knowledge is used (16). The theme, for example, underlying recent sociological research on scientific and technical communications is that scientific communication differs from technological communication and conforms to different sets of behavioral norms. Science is a social process involving communities of freely interacting professionals who seek consensus to establish knowledge. In industry, however, technologists are constrained in their information transfer activities by the policies of their organizations and may hold back information to gain competitive advantage.

This view implies that industrial organizations currently protect themselves to varying degrees by controlling information flows across their boundaries; that information which is exchanged with those outside the organization is perceived to have the potential to destroy competitive advantage; and that scientific and technical information channels which permit such exchange, however efficient, are not likely to be used heavily.

The Wolek and Griffith paper notes that the security of proprietary information is an important issue to industrial firms, and that information activities which permit information leaks could destroy a primary motivator of industrial innovation (16). A case study cited by them involves a manufacturer of space suits who tried to block the move of one of its engineers to a competing firm. Their case illustrates the point that the range of policies affecting industrial knowledge acquisition is broad, including the legal authority of firms to enforce contracts with employees and consultants. However, Wolek and Griffith do not treat other aspects of government policy that are likely to influence security of information. Nor do they provide the decision-rules firms use to make tradeoffs between security and disclosure.

Cuddihy, in a review of science information transfer in the drug industry, notes the conflicts between the confidentiality preferences of firms and public access to information as it affects reporting/disclosure procedures to the Food and Drug Administration (FDA)(17). In the drug industry, he says, currently there is no satisfactory solution for dealing with the scientific information related to compounds failing to reach the marketplace because of FDA non-approval. He indicates that this represents a large amount of information with potential value to industry researchers. The FDA, however, has declined to consider this material available under the Freedom of Information Act.

The issue is, as he describes it, that although it is perceived that the information might advance industry research, there is the important consideration of protecting the confidentiality

of manufacturers. This is because it is unclear whether drugs denied approval by the FDA are still being pursued under corporate research programs.

As indicated earlier, some studies show that information transfer to industrial firms is an important element in industrial innovation. Other analyses, as was pointed out, indicate that the policies of industrial organizations toward the transfer of information may be very important in influencing their involvement in information exchange.

The set of federal incentives/regulations influencing these organizational policies concerning information transfer is quite broad. Knight, Kozmetsky, and Baca reviewed various government incentives and regulations influencing information exchange with spokesmen from nine industries to assess the perceived impact of these policies on technological innovation (18). Incentives included support of education, information exchange and assistance, technology information banks, patents, and R & D demonstrations. The regulations included constraints on advertising and product information, on reporting requirements, on disclosure requirements, and on national and international standards setting.

Their results suggest that the perceived influence of federal incentives/regulations on information exchange varies substantially across industries with drug, computer, agribusiness, food processing, and metal fabricating industry representatives indicating that information exchange is clearly influenced by federal regulations and incentives. Within these industries the incentives/regulations affecting information transfer vary widely: agribusiness is influenced by the agricultural research utilization system; the computer industry is impacted by patent laws (which currently offer only weak protection of software) and government-supported R & D; and in the drug industry, patent policy, disclosure/reporting requirements to the FDA, and by federal control over advertising seem important.

Additional insight and empirical evidence on these broader

issues is provided by the patent policy literature that focuses on patent protection and exclusive licenses as a means of gaining and retaining competitive advantage (19).

Consideration of the patent literature suggests that if the objective of government policy is to encourage more active contacts getween industrial firms and universities, patent and associated policies seem to constitute appropriate policy tools with which to protect technological advances. It implies that mechanisms such as patents, which provide firms with safety from additional disclosure, offer a viable alternative to government programs and policies directed at encouraging more information exchange.

C. What are the Objectives of Public Law 96-517?

After many years of public debate on means to enhance the utilization of the results of government-funded research, the last Congress enacted the Patent and Trademark Amendments of 1980 (P.L. 96-517). Sections 202-204 of the Act give universities, non-profit organizations, and small businesses a first right of refusal to title in inventions they have made while performing on government grants and contracts. Further, in creating this right to ownership, the Act abolishes approximately 26 conflicting statutory and administrative policies across the United States government.

The bill allows universities, small businesses, and non-profit organizations to retain patent rights to inventions that they make under federally-supported research and development programs if they are willing to spend the needed money to develop and market these inventions. The bill also protects the "legitimate" rights of the funding agency to use the invention on behalf of the government. A section also requires the patent holder to reimburse the government whenever an invention achieves a certain level of success in the marketplace within two years. The bill

creates—for the first time—a uniform patent policy for every agency and thus ends the confusion caused by different, and sometimes contradictory, policies.

The overall intent of the bill is to stimulate technological innovation and change in the United States through greater and faster commercialization of inventions resulting from research (primarily basic research) funded by the United States government. This is to be accomplished in several ways. First, it provides industry with an incentive—exclusive licenses granted by universities—to commit the time and money needed to commercialize discoveries. Second, in the case of university work sponsored by the government, title to patents generated under the work would go to the university, thus providing an incentive to the institution to identify patentable ideas, to seek industrial clients to develop these ideas, and to remain involved in the possible development of the patentable discovery.

Further, by changing ownership rights and transfer conditions for discoveries, the bill provides for government a "new" and optimistically more effective role in stimulating the growth of high-technology industries. Also, the bill defines the scope and degree of the "watchdog" responsibilities of the government: universities cannot sit on their inventions and use patent rights to prevent others from practicing them; as the government retains certain rights to the invention, "the public interest" is not completely controlled for private ends; the pay-back provision requires inventors who make large profits to reimburse federal agencies for the support they received.

Finally, the bill, in providing uniform patent legislation, lowers the "transactions" costs for all concerned: government, universities, and industry.

The next section considers the possible impacts of these reforms on commercialization of university-generated inventions.

D. What Are the Likely Impacts of the Patent Reform?

1. Much of the interest in patent reform has been based on the belief that industry did not have adequate assurance that its investment to develop and to market university-generated inventions would be protected. That is, to develop and market government-funded inventions generated in university laboratories, a firm must bear technical costs and financial risks. Further, when other business firms observe the innovating firm's success, they enter the market with similar or equal products or processes.

This implies imitation of the innovations which embody the inventions and a rapid decline in prices until production and marketing costs are barely covered. But innovators are unlikely to bear the costs and risks of developing and introducing a new technology unless they can expect to be sheltered from competitors long enough to recoup or more than recoup their early investment. By inhibiting and delaying imitation, patent protection prevents "premature" erosion of innovators' profits and also instills expectations in the minds of would-be innovating firms that their efforts stand a chance of being rewarded.

However, the extent to which patent protection will stimulate commercial utilization is more complex than simple consideration of recouping the development costs needed to exploit the invention. Statistical results of a Harbridge House questionnaire survey, for example, show that the possession of exclusive rights is associated with commercialization but that there are variables, notably prior commercial experience, much more important as a determinant of utilization (19).

The incentive to innovate depends upon the interrelation of at least four variables: the costs of innovation, the risks, the payoffs potentially attainable if the firm is technically and commercially successful, and the rate at which competitive imitation occurs which, in turn, depends at least partially upon the strength of patent protection available to the innovating firm.

First, however, there is no easy answer to the question of the level of private investment necessary to develop government-sponsored inventions for commerical use. The research and development costs of some innovations are enormous—more than one billion dollars. On the other hand, many other R & D projects are cheap, under $50,000. Studies show that the distribution of values for R & D project costs is highly skewed; that is, there are many low-expenditure projects and relatively few high-expenditure projects, but the few high-expenditure projects are so large that they account for a share of total R & D outlays far out of proportion to their number.

Second, while it seems clear that business enterprises do perceive considerable risk in their R & D programs, how sizable the risk-insurance which companies require before undertaking a project is unclear. Third, the profit a company earns from an innovation depends upon both the innovation's absolute profit potential and what happens on the competitive front.

The rapidity of competitive imitation hinges, in turn, on barriers to imitation. But exclusive rights are by no means the only barriers to imitation in many cases. In evaluating exclusive rights it is important to consider the effect of other barriers, including secrecy, know-how advantages, and structural barriers to entry.

The importance of patent protection as compared with these other barriers varies with at least three factors: field, type of technology, and firm.

As detailed by Scherer, a 1973 survey of UK industrial firms reports that fields varied widely in the extent to which they relied on the government patent system as opposed to unpatented "know-how" to ensure protection from imitation (19).

In the electronics field (electronic, radio, and television components and or equipment), the reasons given for the unimportance of patent protection include the difficulty of establishing novelty under a patent; the possibility of designing around

patented features; and the fact that product life-cycles development lead times are long. In the electrical and mechanical machinery fields, as well as in the electronics field, unpatented know-how was concluded to provide stronger protection from imitation than the patent system.

Second, individual technologies vary widely in the extent to which they are amenable to know-how protection and also in the difficulty of "inventing around" patented features. At one extreme is the design of an aircraft or a large-scale integrated circuit. For aircraft, almost all the design and development work must be done again by a near imitator unless the innovator turns over all the detailed drawings, stress test results, machine tool control tapes, etc. Similarly, with respect to large-scale integrated circuits, finding out exactly what materials to deposit in what strata and achieving acceptable yields is a formidable task that can only be accomplished through costly trial and error.

Near the other extreme would be many pharmaceuticals. Before 1962, it was very easy to "free ride" with identical or slightly manipulated imitative molecules. However, the FDAs implementation of 1962 legislation requiring stringent clinical tests has greatly increased the costs of imitation. Clinical test data are kept secret and imitators must repeat the entire test procedure for the same molecule even when patent protection is unavailable. In addition, the ease of inventing around a patented molecule seems to vary widely. Inventing around antibiotic patents is relatively easy, and variants proliferate. On the other hand, no one seems to have found anything matching Hoffmann LaRoche's Librium and Valium, even though at least 2000 molecular variants have been tried.

Finally, companies with appreciable market shares in industries may enjoy some protection from imitation because of entry barriers such as scale economies, well-established distribution channels, and accumulated brand recognition. Rival firms are likely to imitate but the entry barriers may assure the innovator that it

will do no worse than maintain its historical market share. As a result, even when imitation is rapid, the oligopolistic innovator is apt to enjoy an interlude of several years before price adjustments shift the innovation-commented benefits from the sellers to the consumers.

Barriers to imitation are important in providing expectations in the minds of would-be innovators that they will reap a sufficient share of benefits from their technical contributions to recoup and even make a profit on their development investments. Patents are one such barrier to imitation. But they are not the only ones. A key challenge of patent policy is to adjust the strength of the patent claim on the exclusivity of the license so that it complements those other barriers as effectively as possible.

Scherer identifies four factors which are important in cases where exclusivity could turn the tide toward use: (1) when the firm is small both absolutely and in relation to the relevant market; (2) when the firm has no prior commerical position and will have to break into a field; (3) when substantial technical development costs and risks remain; and (4) when the relevant market is small in relation to expected development costs (19).

Conversely, utilization is likely without exclusive rights when these conditions are absent especially when the market is large in comparison to development costs, when the invention is in a somewhat advanced state of development, or when the firm has a solid commercial stake in the market and believes it can obtain an advantage over its competitors by introducing the invention first.

2. A second frequently discussed impediment in prior patent policy to commercial utilization was the lack of sufficient inducement for universities and academic researchers to divulge new inventions.

Traditionally, educational institutions and for-profit insti-

tutions are considered sharply distinct from one another. Academic institutions are in the business of education and training, and therefore, university research is necessarily oriented toward the educational experience and the extension of fundamental knowledge. University research seldom is directed toward new commercial products or processes. The emphasis is on basic science and engineering, not development and commercialization. The time frame for obtaining and reporting results is long-term. Freedom of communication and publication in the open literature is at the heart of the academic research process. Intellectual independence is paramount.

In contrast, industrial research and development normally looks toward commercialization of new and improved products, processes, and services. Because a competitive edge is necessary to the success of a commercial venture, often the results of research are proprietary and may not be published.

Study results and expert opinions claim recent significant changes in this dichotomy. Educational institutions in the past were more concerned with publishing the results of their research than with promoting patents that may arise from it. More recently, however, schools with large government research programs are taking an interest in their patent portfolios and are seeking, through a variety of means, to promote them through licenses with industry. Universities are increasingly viewing their patents as a potentially useful source of income and actively seeking to license them.

To put this in other terms, traditionally universities are thought of as having no incentive to deter imitation of their research products. They are organizations that cannot expand into the territory of others and know that others cannot encroach on their territory; they have little to gain from preventing others from adopting their inventions. Further, there are formal arrangements and systems for cooperation and flow of information between these organizations. Professional societies, not the mar-

ket, set values and judge the merit of new inventions. A professional stamp of approval, and the adoption pattern it stimulates, often are the only standards of merit available to professionals.

The more recent view which argues for additional incentives to encourage utilization of university-geneated inventions implies that the distinctions between universities and industrial firms are not that deep. True, universities can only achieve utilization of their inventions by licensing others while industrial firms can promote utilization through direct use and licensing. But there are growing incentives for the university to deter at least some imitation.

Several key assumptions underlie the claim that exclusive patent rights will induce universities to commercialize more inventions. First, in the industrial sector, patents provide the inventor with one alternative to secrecy. Patents encourage dissemination. But in the academic world publication is central to scholarly pursuit. The goal is publication in journals or books. This factor led the Harbridge House study to conclude that the single most difficult task of a university patent administrator was the solicitation of inventions among their academic community (20). They found it not uncommon that even where cooperation was obtained often the patent was not reported until many months after publication. Further, universities, even if predisposed to do so, cannot deal in trade secrets since "publish or perish" is the rule and therefore universities are unlikely to control publication by its faculty (21).

The issue is not likely to disappear. The development of the field and commerce of genetic engineering is a prime example of the conflicts involved. The view has been expressed that Stanford University, for example, has put itself at a disadvantage by allowing its scientists to publish before applying for certain European patent rights, thereby forfeiting them altogether (22). Scientists have expressed some concern that applying for

patent rights has influenced the exchange of scientific knowledge and delayed the publication of experimental results (23). Industry-university cooperative efforts increasingly include intricate clauses about the timing of publication versus patenting. Sponsors check research reports to catch anything that is patentable before publication, even though academics have publication rights (21). It would seem apparent that for both patent protection and the traditional dissemination of scientific information system to work effectively, a rather fine balance is going to be required between the two mechanisms.

A second assumption involves the contributions to innovation likely to be made by the research carried on in universities. Based on the rate of government R & D funding of universities for fiscal year 1980, the reformed patent act covers approximately 5 billion dollars to universities and non-profit organizations. The 5 billion dollars utilized by universities and non-profit organizations covers approximately 65% of the total cost of all the basic research conducted in the United States.

But studies in general find basic research to be significant as a direct source of industrial innovations only with substantial time lags. Project Hindsight was the first of a series of attempts to trace (military) technological advances back to their scientific origins. Within the twenty year horizon of its backward search, Hindsight was able to find very little contribution to military hardware development from basic research (24). Project TRACES, partially in response to the military context of the Hindsight results, succeeded in tracing the origins of six industrial innovations back to underlying basic sciences, but only after extending the time horizon well beyond twenty years (25). In a follow-up study, Battelle investigators found similar lags in five more innovations (26).

Langrish also finds little support for extensive use of the scientific literature in support of the technological innovation process (27). Allen adds to these results, also indicating low

use of scientific literature among technologists (11). Technologists do use scientific information, these studies show, but it is more often the "packed down" type of knowledge dervied from textbooks and general science publications, not the results of "cutting-edge" research.

The modest contribution of university-originated research to the innovation process is questioned to some extent by one study which found that about one-third of the input into the innovations studied could be classified as scientific (28). However, unlike some of the other studies reported above, this one takes a less-restrictive view of what constitutes "science" and includes information input to technical problem-solving as well as contributions to the origins of innovation.

In general, this evidence suggests that basic research considered narrowly accounts for only a small portion of the knowledge used in industrial innovation.

On the other hand, such views are quantitative, not qualitative, estimates of the contributions of research to industrial innovation. Many scholars of scientific progress point out that underlying the technologies that have experienced the most rapid advance, or built into a key component of these, is a relatively well-articulated scientific knowledge (29). Others propose that the gap between basic research and industrial processes narrows in such high-growth fields as microelectronics and molecular biology (30).

Allen claims that some technologies are more dependent upon basic science than others (11). Through an analysis of citations in the technical literature, a great dependence on science was found in nuclear engineering, electronics, and metallurgical engineering, in comparison with mechanical engineering. A British report on university-industry relations found that, in general, it is the high-technology industries that have the most contacts with the university, and make most use of university consultants (14).

The key question then becomes: to what extent are the direc-

tions in which science advances inevitable, and to what extent can these be molded by conscious policy? It is apparent that the evolution of basic scientific understanding in any field has a logic and momentum of its own. To try to direct that evolution with precision or to believe that improvements of fundamental understanding can be achieved because the rewards have been changed and or increased is not the question. Historians of science point out, however, that the fields of aerodynamics and applied thermodynamics evolved as rapidly as they did not merely because they were ripe and groups of academic were interested in them. Rather, they were nurtured carefully and funds and institutions were provided for their development. Similarly, both in agriculture and in medicine, institutions and public funds have been established to further the advance of knowledge that feeds into the technologies (29). The old question was how to encourage the utilization of knowledge already produced. The new question is how knowledge production will be changed by reforms in the conditions under which universities supply that knowledge to industry and to society.

There are three subsidiary issues: First, what are the attitudes of scientists and government policy-makers to changes in the direction of science?

Certainly there has been recent concern on the part of the government whether the rush to commercialize genetic engineering is not "compromising" the scholarly independence of university scientists. Last June, two subcommittees of the House Science and Technology Committee held the first of several hearings on the matter (31). Scientists such as Dr. Carl Djerassi, who developed close ties with the pharmaceutical industry as a result of his pioneering research in oral contraceptives, dismiss such concerns. On the other hand, the problem of "distorting" basic research was responsible, in a large part, for Harvard's recent decision to reject the notion of going into business with some of its biologists to market biotechnology (31).

The second related issue is the impediment to increased utilization due to unpatentable knowledge. The issue of unpatentable subject matter especially is germane because difficulties have centered around new fields and basic knowledge. In the United States, for example, the laws of physics and mathematics as not patentable because, for one reason, claims cannot be drafted successfully. Effects of the law of gravity are so numerous that a successful set of claims drafted against observed results would be indefinitely long and would still leave a doubt whether those results might not be the consequence, at least in part, of some other natural laws.

In March, the Supreme Court ruled for the first time that an invention based on a computer program may be patented (32). Inventions involving computer programs formerly had been prohibited because they are mathematical formulas. The justices agreed that a formula or computer program by itself could not be patented. But when a new use for it creates a new process, the court said, it may be patentable. The justices noted that the court had ruled new computer programs unpatentable in a 1978 decision. The application at issue here, however, was not for a new formula, but for an old one put to new use.

The patent office had rejected the computer program application as unpatentable subject matter, determining that the only thing that made the process new was the use of the equation. A patent on the process, therefore, would patent the equation. An appeals court reversed the patent office, and the Justice Department appealed to the Supreme Court. The decision was that the company was not seeking to patent an equation by itself, but a process employing the equation. The company was seeking to foreclose from others the use of that equation *only* in conjunction with all of the other steps in the process.

This was the second major Supreme Court decision recently to open up the patent laws to new technology. Earlier, the justices had ruled patentable the products of genetic engineering.

Questions over the patentability of newer areas of technology such as computer programs and products of biological research are almost certain to continue to be raised and tested in court cases. Further, in a recent decision, the Supreme Court said that the patentability of new areas of technology should not be resolved by changes in agency practices without explicit direction by Congress through changes in the patent law.

A third assumption involves resolution of problems revolving around the distribution of rewards from new discoveries. For universities, the licensing of additional patents should mean access to new sources of funds at a time when the administration could be cutting back on research spending. But it also will bring problems such as the determination of licensing and royalty terms, the division of the revenues, the degree of exclusivity to be offered, and the monitoring of university and industry contracts to ensure the terms of agreements are being met.

Differences between university and industry licensing of inventions make for some unique problems. First, for firms, there are two roughly distinct kinds of mechanisms for the spread of a profitable invention. One of these is for greater use of an invention by the firm that first introduces it. Second, the firm can license the discovery to other firms, government agencies, or other organizations that will utilize it. In other words, the firm can make a trade-off between use or license which is not available to the university.

Second, university inventions, unlike those of industrial firms, normally "stand alone." The industrial product is often protected by a cordon of patents as illustrated by the list of patents on a packet of Polaroid film. A university invention, on the other hand, is a one-shot patent. The patent claim is likely to be drawn very narrowly. Industry will add to its arsenal as a product is improved. However, a university patent, if it is to be licensed, must be licensed on the initial effort.

Third, university inventions must be licensed for their

royalties only. Universities, unlike firms, cannot transfer their discoveries through cross-licensing agreements since the university has no need to obtain the right to manufacture the inventions of others.

Considering these constraints, universities will still be required to make rather sophisticated licensing decisions. For example, Stanford University recently offered to let any company use its fundamental genetic engineering patent to make new forms of life and new biological products for only $10,000 a year plus future royalties (33). The licensing and royalty terms are being kept reasonable to make sure "lots of players get into the game promptly" and to "increase the probability of valuable new applications for human service." The "Cohen-Boyer patent" as it has come to be called is a rather unique one in that it has the potential of underlying a whole industry, and the determination of a royalty base for it, it has been said, has no precedent. Licensing and royalty revenues could grow to $1 million a year within four to five years with future growth depending on the success of future products.

As another example, in May of 1981, West Germany's Hoechst made a $50 million grant to support basic genetic research at Massachusetts General Hospital in Boston. As a result, Hoechst will have the right to license *exclusively* any patents received by the hospital as a result of work Hoechst supports (34).

The division and use of royalties received is another issue. Such income is often used to cover the costs of patent administration with the remainder to be made available for support of education and scientific research at universities. In the Stanford case, Stanford will get the first 15 percent of any income for administering the licensing. The remaining funds will be divided equally between Stanford University and the University of California (Boyer is at the University of California). Then one-third of Stanford's share will go to its medical school for basic research, one-third will be shared by the school's department of

medicine and genetics, and the final one-third, ordinarily Cohen's by Stanford policy, has been assigned by him for further research and support of post-doctoral fellows.

Finally, licensing agreements bring new kinds of responsibilities to the university. In a lawsuit still pending, M.I.T. is still trying to resolve differences between EXXON and a Boston businessman who claims that EXXON obtained patents from M.I.T. despite the university's letter of intent to grant the license to him. M.I.T. has also come under criticism for granting EXXON unusual privileges in its latest agreement with the M.I.T. Energy Laboratory. These include an irrevocable, worldwide, *nonexclusive*, royalty-free license under all sole and joint contract patents without accounting to M.I.T. On the other side, M.I.T. claims that the agreement allows them to license any patents coming out of the research to interested third parties with no delays (30).

The overall trend is toward more business-like relationships between the university and industry. Patent reform is likely to contribute to this movement. However, considering the problems enumerated above, more sophisticated management is going to be necessary to transfer basic research effectively into practical technology.

3. In order to provide the necessary incentives to universities and industry to encourage transfer and use of inventions, PL 96-571 moved ownership rights to discoveries to the private sector. But several situations have been identified in which the "public interest" would be served better through government ownership of patent rights. To minimize these negative effects, the bill includes several "regulatory" privileges for the government to make sure private sector transactions are in the public interest. These include:

- monitoring university transfer capabilities to assure their adequacy;

- government retention of certain rights to inventions; and

- pay-back provisions to reimburse federal agencies.

A first situation, toward which these regulations are directed, is one in which an agency sponsors research in response to a particular public need, such as the Department of Agriculture's sponsorship of investigations into methods of processing various food products. In this case, the presumption is that the government, and not any private party, should have the rights to control the utilization of the inventions. Otherwise, the agency could discover the research spending unproductive if the contractor sat upon his invention, used his patent rights to prevent others from practicing it, and reaped monopoly profits.

A second situation stems from uneasiness over the prospect of private control in areas of public need. The worse-case scenario concerns the government contractor who discovers a cure for cancer and then extorts billions from the sick and dying in addition to having been fully-paid for his research work.

A third situation involves diminishing the possibility of the government stumbling into the role of Dr. Frankenstein for some monopolistic monster. The classic example is atomic energy. Since that technology was unexplored before the United States undertook to fund a major R & D effort, there was a chance that a government contractor might make a basic invention which would give him effective control of the entire field.

The scenarios represented in these situations make at least three assumptions:

1. The government will do more for the social good than private sector suppliers in transferring discoveries. The problem with this assumption is that the government's actions may be as much determined by influence, special interests, and bureaucratic idiosyncracies, as by the social good. The weight of special interests seeking to influ-

ence the transfer of discoveries to the market are far from identical and there is no reason to believe that the resulting political decisions will be exactly reflective of social needs.

2. The scenarios inaccurately or incompletely characterize the private sector. Arguments for government ownership become moot in these situations where strong competitive possibilities exist.

3. Existing government regulations on drugs, public safety, and other essential areas to ameliorate the worrisome situations are not considered.

Overall, the arguments for government ownership of patents are not very strong. More salient are the criticisms which have been directed toward the safeguards; these have noted that with the safeguards, the bill does not provide appreciable relief from overly restrictive and unnecessary reporting procedures. P.L. 96-517, in essence, moved patent policy toward universities from a government ownership position to a regulatory one. In those areas where regulation can be replaced by competition, most economists believe that competition is the superior choice. This is not the place to push these arguments too far. Rather, the completely competitive option is put forth as illustrative of those that will arise naturally as this is implemented.

CONCLUSIONS

Patents do make a difference. There now exists a fairly solid knowledge, some of which has been presented here, for understanding how patent policy affects industrial firms. With respect to universities, we are in less well-chartered waters.

What effects does the capacity to do extensive, exclusive licensing have on the R & D programs in which universities engage? Will patent reform induce basic research to be absorbed more speedily in technological innovation? There are great gaps in our knowledge.

Further, the process in *most* cases of converting scientific advance into new products and processes is complex and time consuming. Studies of *major* twentieth century innovations indicate that the time interval between its inventions and its commercial use averages between ten to twenty years. We would be overly optimistic to expect the full impacts of this patent reform to produce economic returns in the short run.

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PATENT POLICIES FOR GOVERNMENT-SUPPORTED RESEARCH *(JAPAN)*

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GENERAL DESCRIPTION

The current patent system in Japan is based on the Patent Law that was enacted in 1899 and extensively ammended in 1960.

When discussing patent policies for government-supported research in Japan, we need to consider them in two categories:

(1) the case of a researcher or university professor who, as a government employee, conceives an invention in direct re-

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lation to his research work; and

(2) the case of a non-governmental employee who does research, supported by government funds, which eventually results in an invention.

In the first category, it has been deemed that the patent right for an invention by a government employee, such as a researcher of a national research institute, belongs to the government. However, in the case of a national university professor, there has been a long argument as to whether the patent right should belong to the government or to the individual inventor, as research work at a university is not directly related to the specific purposes which may result in an invention. In other words, it is not the duty of a university professor to create inventions. In practice, policies have been decided by university authorities.

The Science Council, an advisory body of the Ministry of Education, Science, and Culture (MESC), drew up guidelines on this matter in June of 1977. The necessary financial and administrative measures have now been taken on the basis of these guidelines, and the major issues have been resolved. We will refer to this latter.

In the second category, that of a non-governmental employee using governmental funds for his research, the title to the patent should be determined in accordance with the terms of the contract agreed upon between the government as the funding party, and the individual as the receiving party because, in this case, the government does not have the status of an employer. Therefore, in such a contract, the terms governing the possession of the patent right to any possible invention should be decided after taking into consideration the purpose and type of government funds, the characteristics of the research, etc.

There are various types of research funded by the government

such as contract research, research with grant-in-aid, joint research projects, and others. In these various types of research not only are there different levels of government fundings, but there are varying degrees of contribution by the inventor. For this reason the terms concerning patent rights in a contract vary accordingly.

However, the real policy of the Japanese government is to retain the patent right. So it could be said that the so-called "Title Policy" has been adopted by the Japanese Government particularly for the case of contract research. For instance, in handling a patent resulting from research done under a contract between the government and a private enterprise, the government holds the patent right granting license for priority use to the enterprise.

TREATMENT OF A PATENT RESULTING FROM AN INVENTION BY A NATIONAL UNIVERSITY PROFESSOR

Why is the treatment of a patent resulting from an invention by a national university professor an important point when discussing patent policies for government-supported research in Japan? Firstly, the basic policy in Japanese Patent Law is that the patent right is generated by an inventor and it should belong to the inventor except in the case of the invention of an employee. Secondly, most universities whose research activities are supported by government, particularly in natural science, are national universities. Therefore most researchers who receive government support are government officials.

The guidelines drawn up by the Science Council and mentioned earlier are summarized here:

What is an employee's invention in the case of a university researcher? This was a main issue which the Science Council of MESC considered. It pointed out that the research activity of a university professor differs greatly from work done at the research institute of a private corporation. The latter is usually done under directed supervision to achieve the specific goal of the institute, while a university researcher can conduct his research freely. After analyzing the characteristics of a university professor's research work, the conclusion was reached that the patent right to an invention resulting from his research should not be transferred to the government in principle, but that an inventor does have the obligation to transfer that right in the following special cases:

(1) when an invention results from applied research that was done with the substantial support of special government funds; and

(2) when an invention results from applied research, using government's facilities secured particularly for the implementation of specific research.

Upon receipt of a notice of an invention which may be patented from an inventor, it is to be decided by a committee within the university whether or not the invention falls into either of these categories. All universities are therefore required to set up a system to review these issues.

The Japan Society for the Promotion of Science (JSPS) is to be entrusted by the government with the establishment of a system to submit patent applications on behalf of national university professors and to handle all applications on behalf of national university professors and to handle all matters relating to the acquisition, execution, and adminis-

tration of those patent cases.

In accordance with these guidelines, the government and the universities took the necessary action and this system of the administration of patent rights for university professors has been in operation since 1978.

BENEFITS OF THE ABOVE MENTIONED PATENT POLICIES

The benefits of the new patent system can be pointed out as follows:

(1) Inequities among university policies on patent rights applied for by professors have been decreased by the introduction of a single guideline.

(2) The policy that the patent right resulting from an invention by a university professor should belong, in principle, to the individual has stimulated university professors to acquire patent rights.

(3) With the assistance of the JSPS, it has become possible, effectively, for a university professor to acquire a patent for an invention.

FURTHER PROBLEMS

(1) The amount of compensation paid to an inventor is small when the government is the owner of the patent. The actual amount of such compensation for the government employee is deter-

mined, at the present time, by the Patent Office. In the case of national university professors, it is desirable that, in addition to the compensation, the government provide the inventor with a special research fund. This point has been noted in the guidelines but has not yet been implemented.

(2) The assignment of patent rights resulting from research done at national universities under contract with private corporations, needs further consideration.

PATENT POLICIES FOR GOVERNMENT-SUPPORTED RESEARCH *(USA)*

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Creative destruction is the essential fact about capitalism...it is, by nature, a form or method of economic change, and not only never is—but never can be stationary.... The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumer goods, the new methods of production...the new markets, the new form of industrial organization that capitalist enterprise creates.

Joseph Schumpeter, Economist

INTRODUCTION

In a free society, man's entrepreneurial spirit tells him he *has* to improve on existing products, processes, and procedures if he is to create a competitive edge for himself, or even just to meet competition. Such activities, however, absolutely depend upon the willingness of government to welcome, in the future, innovation without the regulatory inhibitions and controls which tend to accompany the highly bureaucratic organization which the

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government represents today.

Of all the controversial subjects which have been addressed by members of Congress and discussed by newspaper editors and columnists over the years, none appears to be less understood than the policy governing the allocation and disposition of rights to inventions arising out of government-financed research and development.

The basic issue is whether the government should always take the commerical rights to patentable inventions generated under a government-sponsored contract or from government-funded research, or whether such rights would better be left with the contractor or fund recipient to permit him to utilize the patent system in transferring the technology developed to the public sector for its benefit.

The talent of invention—an expression of intellectual originality—must be given the maximum encouragement by providing the invetor with all necessary stimuli to inventive activity. Patent laws should provide the major stimulus to such activity for they are inteded to afford the inventor protection for his intellectual property. These laws were enacted under the specific power conveyed by the United States Constitution in the following language:

> The Congress shall have the power...to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.
>
> (Article I, Section 8)

It is significant that the patent laws of the United States do not convey to an inventor, or to his assignee, or to his licensee the right to use or to practice the idea patented. Rather, a patent conveys the right to exclude others from making,

using, or selling the invention throughout the United States. Moreover, the right to exclude, conveyed by the grant of a patent, is characterized by the patent laws (35 United States Code 261) as a property right.

BASIC CONSIDERATIONS

In general there is agreement in both the government and the private sector that the considerations basic to the Statement of Government Patent Policy should be the following:

(a) The government expends large sums for conducting research and development which result in a considerable number of inventions and discoveries.

(b) The inventions in scientific and technological fields resulting from work performed under government contracts constitute a valuable national resource.

(c) The use and practice of these inventions and discoveries should stimulate inventors, meet the needs of the government, recognize the equities of the contractor, and serve the public interest.

(d) The public interest, in a dynamic and efficient economy, requires that efforts be made to encourage the expenditious development and civilian use of these inventions. Both the need for incentives to draw forth private initiatives to this end and the need to promote healthy competition in industry must be weighed in the disposition of patent rights under government contracts. Where exclusive rights are acquired by the contractor, he remains subject to the provisions of the antitrust laws.

(e) The public interest is also served by sharing the benefits of government-financed research and development with foreign countries to a degree consistent with our international programs and with the objectives of United States foreign policy.

(f) There is growing importance attached to the acquisition of foreign patent rights in furtherance of the interest of United States industry and the government.

(g) The prudent administration of government research and development calls for a government-wide policy on the disposition of inventions made under government contracts. The policy must reflect common principles and objectives to an extent consistent with the missions of the respective agencies, and must also recognize the need for flexibility to accommodate special situations.

HISTORICAL BACKGROUND

During the early history of the United States, very little technical development work was done by the government, and therefore, as a practical matter, the question of the government owning a patent never arose. Federal agencies gradually undertook the practical kinds of development work which led to inventions. Prior to World War II almost all government-financed research and development work was conducted in federal laboratories by full-time government employees. There was a small, recurring problem of what to do with inventions resulting from such work—inventions which, if developed by private parties, would have become the subject of patent applications.

This situation changed rapidly during and after World War II. The technological requirements imposed by more and more sophisti-

cated military requirements—as well as the increasing complexity of support services—made it evident very quickly that there were not sufficient resources within the government to undertake all the scientific projects necessary to a winning war effort. The absolute necessity to utilize the best technical ability available, regardless of its locus, spawned a rapid proliferation of government-sponsored and government-funded research and development contracts.

The proper disposition of rights to patents resulting from this work was theoretically as important then as it is now but was never seriously addressed as a major problem because of the exigencies of wartime needs.

After World War II the rapid technological strides made under the impetus of a wartime footing and the obvious necessity for continued technological superiority, at least in defense-oriented efforts, made it imperative to continue to provide public support for science. Nor was this support limited to the military. For example, in 1950 Congress finally provided an annual budget of $15 million for the National Science Foundation to conduct basic scientific research at universities.

During this same period hundreds of millions of dollars were appropriated by the government to the area of medical research for the beginning of an all-out attack on disease.

With the rapid expansion of scientific projects undertaken and supported by the government, shortages of technical ability and facilities continued to prevail as they had during the pressures of World War II. Since the government could not do all the necessary work in its own facilities, qualified private companies, universities, and nonprofit organizations were sought to perform many programs via contractual arrangements. And the same old problem of ownership of patent rights existed in every one of the contracts.

Since there was no single or over-riding patent policy upon which the government could rely, each governmental agency that

supported a research and/or development effort, through contractual and/or grant arrangements, developed its own policy. The obvious result was that many policies evolved. At one extreme, some agencies advocated the "title" policy. At the other extreme were those agencies advocating the "license" policy. There were also many and varied policies between those two extremes.

Governmental agencies operating under the "title" policy insisted on acquiring title to all contract-generated inventions and the patents on them (including inventions which were only incidental to the major purpose of the contract), and then dedicating them to the public through publication or by offering a license on a nonexclusive, royalty-free basis under any patents obtained to all who requested it. The argument was that all these inventions, including the incidental inventions, should be acquired because they had been "paid for" by the government and should therefore be owned by the government.[1]

Agencies which adopted the "license" policy permitted the contractor to take and keep title to inventions and patents arising under the contract, while reserving a royalty-free license in the government to practice the invention for all government purposes. The theory which these agencies applied was that inventions and patents were only incidental to the specific research or products contracted for and that equity demanded nothing more than a royalty-free right for the government to use the inventions.

Other theories and contentions made by the advocates of the

[1]*See, Public Citizen v. Sampson, 379F Supp. 662 (D.D.C. 1924) aff'd, 515 F.2d 1018 (D.C. Cir. 1975); Press release by Senator Gaylord Nelson (Wis.) of the Senate Monopoly Subcommittee of the Senate Small Business Committee on Dec. 9, 1977 re the government giving rights to inventions to contractors; Also, hearings held by Senator Nelson on GSA proposed changes in the FPR issued March 18, 1978; Hearings before the Subcommittee on Monopoly and Anticompetitive Activities of the Select Committee on Small Business United States Senate, 95th Congress, 2nd Session on Government Patent Policies, May 22, 23, June 20, 21, and 26, 1978.*

two policies, each in support of its own position, tended to finally so polarize the two groups that ultimate compromise seemed impossible.

MEMORANDUM AND STATEMENT OF GOVERNMENT PATENT POLICY

In 1963 Jerome Wiesner, President Kennedy's Science Advisor, recognized a need for some guidelines to effect a more uniform government policy toward inventions and patents on a government-wide basis. The results of Dr. Wiesner's study culminated in the Policy Statement issued on October 10, 1963 by President Kennedy to establish government-wide objectives and criteria, subject to existing statutory requirements, for the allocation of rights to inventions as between the government and its contractors which would best serve the overall public interest while encouraging development and utilization of the inventions.[2]

Since the policy, as promulgated, would most likely have to be revised after experience had been gained in operating under it, a Patent Advisory Panel was established under the Federal Council for Science and Technology to assist agencies in implementing the policy. The Panel would acquire data on the agencies' operations under the policy and make recommendations regarding the utilization of government-owned patents. In December 1965, the Federal Council established the Committee on Government Patent Policy to assess how the policy was working.

The studies and experience of the Committee and the Panel culminated in the issuance of a revised Statement of Government Patent Policy by President Nixon on August 23, 1971.[3] The

[2]*Presidential Memorandum and Statement of Government Patent Policy (F.R.) Vol. 28, No. 200, October 12, 1963.*

[3]*Presidential Memorandum and Statement of Government Patent Policy (F.R.) Vol. 66, No. 166, August 26, 1971.*

changes effected in the Nixon Policy Statement were made as a result of the analysis of the effects of the policy on the public interest over the seven years from the Kennedy Policy Statement. It was stated that the sudies and experience over the seven years indicated that:

(a) A single presumption of ownership of patent rights to government-sponsored inventions either in the government or its contractors is not a satisfactory basis for government patent policy, and that a flexible, government-wide policy best serves the public interest.

(b) The commerical utilization of government-sponsored inventions, the participation of industry in government research and development programs, and commerical competition can be influenced by the following factors: the mission of the contracting agency; the purpose and nature of the contract; the commercial applicability and market potential of the invention; the extent to which the invention is developed by the contracting agency; the commerical orientation of the contractor and the extent of his privately financed research in the related technology; and the size, nature, and research orientation of the pertinent industry.

(c) In general, the above factors are reflected in the basic principles of the 1963 Presidential Policy Statement.

Although there is evidence that the guidelines established through the Kennedy and Nixon Statements on Government Patent Policy did bring the patent practices of the agencies into greater harmony, divergent policies still existed. There was a strong presumption, if not evidence as measured by the experienced transfer of technology to the public sector, that the more restrictive the policy of an agency—i.e., the more "title-oriented" the agency was toward inventions and patents generated

under its funding—the less likely it was that the technology represented by those inventions and patents would be transferred to the public for its benefit.

One must remember, however, that the Statements of Patent Policy by two presidents established guidelines only. As a consequence, some twenty-six variant agency policies, all presuming to exist within those guidelines, evolved.

Agency Practices Prior to Effective Date of Public Law 96-517

For purposes of the following discussion, it should be kept in mind that prior to the Patent and Trademark Law Amendments Act of 1980 (PL 96-517, effective July 1, 1981) distinction was maintained between a contract and a grant under government funding and that these terms, in a general manner, could be respectively equated with applied research and basic research. It was considered that work carried out under a government contract had a definite objective—that is, a goal to be achieved that was perceived to be useful to society—whereas work carried out under a government grant had as its only objective the acquisition of knowledge. In general, government agencies were much less willing to waive rights to inventions generated under contract than they were to those evolving from grants.

In general, executive agencies have traditionally interpreted the provisions of the Presidents Statements on Government Patent Policy, or applicable statues, to require the use of patent rights clauses in contracts (and in grants where universities and other nonprofit organizations are involved—grants, until very recently, were not available to commercial or profit-making organizations) to provide either title in the government for inventions generated in the performance of such contracts (or under such grants) or a deferred disposition of patent rights, the disposition of the rights taking place only after the

invention had been identified.

Even when the title clause was traditionally used by an agency, and even where the disposition of patent rights was statutorily controlled as, for example, with the National Aeronautics and Space Administration and with the Energy Research and Development Administration (now the Department of Energy), the patent rights clause permitted the contractor or grantee to request and often obtain the principal rights in an invention, with the agency's agreement, after the invention had been identified.

Fundamentally, there were three clauses which could have been, and which have been, used by the various government agencies. These were:

1. the license policy clause;
2. the deferred patent rights clause; and
3. the title policy clause with waiver privileges.

Experience showed, however, that there was no real consistency among agencies, or within an agency, or even from one contract to the next contract within an agency, as to what the disposition of patent rights would be.

Exemplary of patent policies developed by government agencies which provide the bulk of research and development monies for universities were the following:[4]

Department of Health and Human Services (DHHS): deferred determination, but permitted the use of Institutional Patent Agreements under which certain grantees and contractors are

[4]*For listings of current statutes, regulations, orders, manuals, memoranda, and materials governing allocation of rights to inventions arising from government-sponsored research on an agency-by-agency basis, see, Report on Government Patent Policy by the Federal Council for Science and Technology, U.S. Government Printing Office (1978), 281-067-289. Available from the Superintendent of Documents.*

afforded first option on title to inventions made during the course of a grant or contract.[5]

National Science Foundation (NSF): deferred determination, but permitted the use of Institutional Patent Agreements with certain contractors and grantees.

National Aeronautics and Space Administration (NASA): statutorily controlled; title policy with waiver possibility.

Energy Research and Development Administration (ERDA) now Department of Energy (DOE): statutorily controlled; title policy with waiver possibility.

Department of Transportation (DOT): title policy.

Environmental Protection Agency (EPA): title policy.

Department of Defense (DOD): deferred determination (for health-oriented inventions).

Agency for International Development (AID): title policy with waiver possibility.

Department of Agriculture (DOA): title policy (statute interpretation by Department as permitting only the taking of title).

Veteran's Administration (VA): title policy with waiver possibility. (When a VA employee was a co-inventor, waiver of Government rights not possible.)

[5]*For historical interest regarding Institutional Patent Agreements and early DHHS practice, see Report to the Congress on "Problem Areas Affecting Usefulness of Results of Government-Sponsored Research in Medicinal Chemistry" by the Comptroller General of the United States, August 12, 1968.*

The expression of patent policy for each of the foregoing agencies is stated not necessarily in terms of its written policy, but in terms of its practical operation under the Kennedy and Nixon Patent Policy Statements.

Operating under these policies, the government accumulated in its patent portfolio about 28,000 patents of which only about 5 percent have been licensed, and of this 5 percent, only a small portion have been reflected in commercial products.[6] Thus, with the government in the main espousing a nonexclusive licensing policy, the experience of licensing government-owned patents has irrefutably been one of non-use. Consequently, the intended economic benefits, to be derived from government-sponsored research and meant to be stimulated by the patent system, have not been realized by the government or the public.

An interesting comparison along these lines was made by Harbridge House in a 1968 study of government-funded patents put into use in 1957 and 1962.[7] They found that contractor-held inventions were 10.7 times as likely as government-held inventions to be utilized in products or processes employed in the private sector for the benefit of the public.

This is strong evidence of the inefficiency of government—which is not disciplined by the profit system, as compared to private enterprise which is so disciplined—in the performance of the technology transfer function.

[6]*See Resume of United States Technology Policies, Dr. Betsy Ancker-Johnson, Les Nouvelles* (Journal of the Licensing Executives Society) *December 1976, Vol. XI, No. 4, p. 186; Statement before the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, December 11, 1976. (This latter document also contrasts the experience of universities in licensing patents owned by them, some or most of which may have resulted from research supported in whole or in part by Federal monies.)*

[7]*Harbridge House Inc., Government Patent Policy Study for the FCST Committee on Government Patent Policy, May 15, 1968.*

OPTIMUM PATENT POLICY PRESUMPTION

At the outset it must be presumed that government research dollars are made available in the expectation of not only developing basic knowledge, but also in the expectation that the funded research will lead to products, processes, and techniques which will be useful and acceptable in all or part of our society to improve the well-being of society in general.

In the face of this presumption it is apparent that inventions, whether made through the expenditure of private or governmental funds, are of little value to society unless and until they are utilized by society. In order to achieve such utilization it is essential that the invention be placed in a form or condition which will be acceptable and beneficial to the public. In other words, the technology must somehow be transferred to the public sector.

In a free enterprise system such transfer is normally accomplished as the result of pertinent and appropriate activities of private enterprise. Since such activities obviously entail the commitment and expenditure of substantial monies—many time the amount needed to make the invention[7]—adequate and appropriate incentives to such commitment and expenditures must be afforded. Consequently, since the patent system provides such incentives and is the most viable vehicle for accomplishing the transfer of technology, full and careful consideration must be given to the creation of any policy which will affect the transfer of technology that has been generated in whole or in part by government-funded research.

GOVERNMENT-OWNED PATENT—AN ANOMALY

At this point it would probably be well to consider the situation that occurs when the government does take ownership of a patent. The idea of the government owning a patent is, in a sense, an anomaly. The patent system was created as an incentive to invent, develop, and exploit new technology—to promote science and useful arts for the public benefit. When the government holds the patent under the aegis that the inventions of the patent should be freely available to all, much the same as if the disclosure of the invention had been merely published, the patent system cannot operate in the manner in which it was intended. The incentives inherent in the right to exclude conferred upon the private owner of a patent, and which are, in reality, the inducement to development efforts, are simply not available.

Objectives of Government Patent Policy

There is general agreement that the primary objectives of government patent policy should be to:

1. promote further *private* development and *utilization* of government-supported inventions;

2. ensure that the government's interest in practicing inventions resulting from its support is protected;

3. ensure that patent rights in government-owned inventions are not used for unfair, anticompetitive or suppressive purposes;

4. minimize the cost of administering patent policies through uniform principles; and

5. attract the best qualified contractors.

However, of all of the considerations attendant upon the establishment of a governmental patent policy only one consideration should be paramount: *In whose hands will the vestiture of primary rights to inventions serve to transfer the inventive technology most quickly to the public for its use and benefit?*

Recognition of this paramount consideration was plainly evident from the provisions of the National Science and Technology Policy, Organization and Priorities Act of 1976 which directs the Office of Science and Technology Policy to review current legislation and agency practice with the view of recommending and developing,

> *Federal patent policies...based on uniform principles, which have as their objective the preservation of incentives for technological innovation and the application of procedures which will continue to assure the full use of beneficial technology to serve the public.*[8]

ALTERNATIVES

As previously noted, three major approaches to the disposition of rights in inventions and patents resulting from government-funded research and development have been used by various agencies of the government. These are:

1. *Title or First Option in the Contractor.* Under this approach contractors or grantees, as a general rule, would be allowed to retain title to inventions made under the contract or grant subject to a license to the government and "march-in" rights.

[8]*Title I, Section 101(c)(4) of P.L. 94-282.*

2. *Deferred Rights.* Under this approach, the presumption of title to inventions was in the government with a disposition of those rights taking place only after an invention has been identified.

3. *Title in the Government.*[9] Under this approach, the presumption of title was in the government with the agency selecting the patent clause to be applied to each grant or contract on a case-by-case basis.[10] Where the title clause was used the predilection of the agency was to acquire title to the invention although there still was a possibility of obtaining a waiver of that title in exceptional circumstances.

INSTITUTIONAL PATENT AGREEMENT

The Institutional Patent Agreement (IPA) which was used with universities by the Department of Health and Human Services and the National Science Foundation evolved as a variant of the policies of these agencies.

[9]*Assistant Attorney General John Shenefield, in advocating a title-in-the-government approach in his appearance of December 20, 1977, before the Select Committee on Small Business, United States Senate, stated, "The competitive risk to the public in transferring title to the contractor may be especially high where transfer carries a danger of further entrenching the already strong market positions of many government contractors."*

[10]*The Federal Nonnuclear Energy Research and Development Act of 1974 (42 USC 590) is an example of such an approach. It places the presumption in favor of the government's taking title, but gives ERDA (now DOE) considerable flexibility to decide otherwise, depending on ERDA's evaluation of a variety of factors. In reality, this type of approach, which some claim represents a middle-ground, is not a uniform policy at all since agency practices will vary considerably depending on the predilections of the agency officials involved in the process.*

To obtain an IPA the university had to satisfy the agency that it processed an adequate technology transfer capability. Once granted, the IPA permitted the university to take title to inventions made by its personnel during research sponsored by the granting agency and to patent and license such inventions within the limitations established by the provisions of the IPA. The government always reserved a nonexclusive license to itself to practice any inventions which arose under the IPA for governmental purposes. The government also retained certain "march-in" rights which were keyed: (a) to nonperformance by the university, i.e., lack of genuine attempts to transfer the technology represented by the invention, or (b) to abuses of the privileges extended by the IPA.

UNIFORM PATENT LEGISLATION

Responding in part to a perceived erosion of technological innovation and high-technology development in the United States, a significant piece of legislation, the Patent and Trademark Law Amendments Act (PL 96-517), was signed into law on December 12, 1980 with an effective date of July 1, 1981. Although the law provided for certain amendments to the patent laws which in themselves are not insignificant, the provisions of that Law considered to be of greatest import to universities, other nonprofit organizations, small businesses, and to the topic of this paper, are in the chapter entitled "Patent Rights in Inventions Made with Federal Assistance;" this was added as a new chapter to Title 35 of the United States Code. This chapter, referred to as the Uniform Patent Legislation Act, directly affects the technology transfer relationship between the federal government on one hand, and universities and small businesses on the other hand.

For the first time in history a uniform approach to the dis-

position of patent rights arising from research funded by the government at universities and with small business became a reality on July 1, 1981.

Policy and Objectives

The Law is highly significant in that:

1. it changes the presumption of title in the government to any invention made with federal funds at universities and small businesses to the presumption of title in the contractor-grantee;

2. it allows universities, nonprofit organizations and small business firms to elect to retain title to inventions made by them during the course of federally sponsored research;

3. it makes no distinction between contracts and grants in the disposition of patent rights;

4. it eliminates approximately 26 different and often conflicting and confusing agency patent policies; and

5. it is a recognition by Congress of the value of the patent system, as a whole, to effectuate the transfer of government-funded inventions to the public.

Under the new Law contractors agree to file patent applications on disclosed inventions within a reasonable time and grant to the government a royalty-free license to practice such inventions. Funding agencies may require periodic reports on the utilization of, or the efforts being made to achieve utilization of the invention.

Other Provisions of the New Law

Additional provisions of the new Law:

1. impose a limitation on the granting of exclusive licenses for periods in excess of five years from the first commercial use or sale of an invention, or eight years from the date of the license (except for the time before regulatory agencies obtain premarket clearance) where the licensee is other than a small business;

2. require in the granting of an exclusive license in the United States that the licensee agree that any products embodying the invention, or produced through the use thereof, will be manufactured substantially in the United States; and

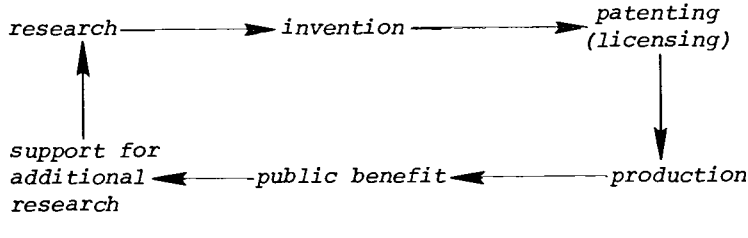
3. require that (where nonprofit organizations are concerned) royalties be shared with the inventors and that remaining funds, after payment of expenses, be utilized to support scientific research or education.

In all cases the government reserves the right, with appropriate appeal procedures for the contractor, to "march-in" and require licensing of the invention where the contractor has not taken steps to achieve practical application of the invention, for reasons of public health and/or safety, or to meet public use needs required by government regulations.

The Law does not, however, establish a completely uniform government policy toward the disposition of rights to inventions made with government funds since it does not apply to all who have research and development contracts with the government. Major corporations, i.e., big business, are not included within the scope of the Law. Such contractors are still subject to the individual agency policies which, in general, have the presumption of title in the government while leaving at least a royalty-free

nonexclusive license with the contractor. Nevertheless, the Law can be expected to have a substantial impact on innovation. Although most applied research and development is carried out by industry, most basic research is done at universities. For example, in 1979 the government supplied $7.3 billion for basic research of which 58.9 percent was spent at universities while 10.1 percent was spent for government installations, 16.4 percent was spent in industry, and 9.6 percent was spent at nonprofit institutions. In contrast, the government supplied $12.2 billion for applied research, of which 59 percent was spent in industry and 15.6 percent was spent at universities. It was estimated that in 1980 the federal obligations for university research would be approximately $3294.1 million, of which $2170.3 million would be utilized for basic research.[11] In addition, approximately $4 billion more was expected to be spent by the government for research by small business; efforts are being made to increase that amount.

Given the amount of federal funds spent for research at universities, and given the measure of success the universities have had to date in transferring technology generated with such funds to the public through judicious use of the patent system, and given the recognized impact small business has had in the development of new and high technology for the market, the benefits which can be realized from the new Uniform Patent Legislation should be readily apparent. As shown below, this new Legislation provides an eminently sensible formula for ensuring the closure of a feedback loop to the support of research through royalty returns or profits.



[11] *See, Chemical and Engineering News, July 28, 1980.*

THE HANDLING OF PATENTS FOR THE INVENTIONS OF UNIVERSITY PROFESSORS *(JAPAN)*

A report prepared by

The Science Council,
Ministry of Education, Science and Culture
(1977)

(a provisional translation)

I. INTRODUCTION

A. Clarification of the Problems and the Aim of This Report

Inventions are the result of human intellectual creative activities and they usually lead to improvement in science and culture. At the same time, the industrial utilization of the inventions would contribute to the development of industry and a higher standard of living of the people. The highly industrialized society of today, where technological improvement is spectacular, expectation is extremely high for the emergence of great inventions which can be applied to industry for the advancement of the national economy and society. The Patent Law of Japan stipulates that, "invention designates high degree creations of technological ideas utilizing natural laws" (Article 2, Paragraph 1 of the Patenet Law), and intends to protect and utilize patented

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inventions as one form of industrial property secured by modern laws. The basic idea of this law is to protect the rights of individual inventors. However, as to the inventions of employees belonging to organizations, employers' rights are also protected providing that they are employee's inventions. Thus, due consideration is given to the contributions of employers toward inventions. This is the system governing employee's inventions.

University professors play a leading role in intellectual creativities; however, there has not been a uniform interpretation and application of provisions for the employee's inventions. Various universities have resorted to different ways. One reason for this lack of uniformity is that there has been the basic question of whether or not university professors' inventions could be handled exactly in the same manner as ordinary employee inventions. It can be said also that university research activities and university professors' inventions have been varied, making it extremely difficult, technically, to handle them uniformly.

However, the various ways of universities handling this problem have brought about not only inequality among university professors but also a serious problem which requires a definite examiniation from the administrative point of view. More importantly, the lack of an effective and suitable system of administering patents makes it difficult to utilize them. As a result, university professors in Japan find it difficult to develop their excellent ideas into inventions or to obtain patents. For this reason, we can say that it presents a problem in the field of scientific research and science technology too. Thus, a solution to this problem has been requested by individual university professors, universities, and industries as well as the national government.

B. Aims and Course of Deliberation

It became necessary to clarify and form a uniform opinion concerning the handling of patents and similar matters for university professors. Deliberations began with the creation of a special committee on patents in the Science Council toward the end of 1975. In addition, in February 1976, the Minister of Education, Science, and Culture consulted us on this matter. During the consultation he instructed us to deliberate, "In order to encourage truly creative research and inventions, to contribute to the world intellectually, and to promote technological advancement, ... while the characteristics of scientific research," and to "define clearly the basic ideas governing the handling of patents and similar matters. Also, to plan the protection and effective utilization of these rights, and examine suitable ways to promote the wide range of scientific research activities which may result in inventions." As a result of deliberations following the purport of the consultation, this Council published its preliminary report in October 1976.

Thereafter, opinions from various quarters were taken into consideration and further deliberations were made, resulting in this reply:

(Substance of this report)

The first section of this report deals with the handling of university professors' patents in the past and present, as well as the reality of obtaining patents. It is followed by the second section in which we describe the patent handling systems in non-university research institutions and related organizations, together with the outline of university and college patents abroad. Based on the above studies we summarized and organized the problems of existing patent handling in the third

section. In the fourth section, the characteristics of scientific research are examined and the basic idea governing the handling of university professors' patents is clarified from this point of view. Finally, the fifth section describes the ideal way of patent handling systems.

The scope of the subject matter in this report includes all universities—national, municipal, and private—as well as private scientific research institutions. The staff includes professors, as well as all related staff members, such as technicians. The industrial property encompasses patent rights as well as utility models.

II. WAYS OF HANDLING UNIVERSITY PROFESSORS' PATENTS AND THE REALITY OF THEIR OBTAINING THEM

A. History of Patent Law and Provisions Concerning Employee's Inventions

The history of industrial property, such as patents, is closely related to the course of industrial development of a country. In Japan, the modern patent system was established with the promulgation of "Provisional Regulations for Monopoly," in 1885 and "Patent Monopoly Ordinance," in 1888. The "Patent Law" of 1899 was promulgated in response to the world trend toward the protection of industrial property. Later, it went through three great revisions, in 1909, 1921, and 1959, each reflecting the measures designed to cope with the leaping development of Japanese industry and the rapid advancement of technology.

Next, we shall consider the changes in the employee's invention system as expressed in patent laws. The revised law of 1909 stipulated that rights of inventions done by employees were

basically acquired by employers as the law said that "except stated otherwise in service regulations or in the contract, the right to obtain patents for inventions done in the line of service or by contract belongs to the executor of the service or the employer" (Article 3). The revised Patent Law of 1921 (hereafter referred to as the "Old Patent Law"), however, was intended to strengthen the position of inventors, making it a rule for an employee-inventor to obtain the right of his patented invention while reserving the license to the employer in due consideration of his interest. Thus, it stipulates that "when an employee obtains the patent for his invention, his employer holds the license providing that the *invention was made in relation to the employee's service,* that by nature *it falls into the scope of his professional service,* and that his actions leading to the invention was a part of the *employee's duties*" (Article 14, Paragraph 2).

The provisions of the present law concerning employee's inventions directly follow the basic philosophy of the Old Patent Law favoring the right of inventors. Differences between the present law and the Old Patent Law are slight. The present law adds service in the past to the necessary condition for the definition of the employee's inventions by stipulating "the inventions belonging to the present and past service." It also clarifies the standard regarding the compensation money the employees should receive. Article 35 of the present law stipulates that when employees (hereafter means employees, officers of juristic persons, national public service personnel, or local public entities) retain the non-exclusive license. It also stipulates that it is invalid for employers to succeed to the inventions of a "non-employee's inventions" by any prearrangement and that employees have the right to receive a compensation of consideration when they turn overto their employers the right to obtain patents or the succession of patent rights, or when they created the exclusive license for their employers.

The employee's invention system in Japan, favoring the right of inventors, has a long history of 55 years. We may say that, especially among large private enterprises, policies concerning patents of their employees have been established. Most private concerns have rules governing their employee's inventions, included in their working regulations, stipulating clearly that patent rights of the employee's inventions are handed over to the employer through prearrangement. Systems are established under which patent specialists take charge of useful "inventions" made by employees and promptly take steps to apply for their patents. Later, compensation of consideration in relation to profit from the patent right are paid and credit for their contributions are calculated accordingly. Enterprises are, we may say, organizations that grow larger as a result of exploitation and accumulation of patents and know-how. Accordingly, their systems of utilizing patents are effectively organized.

Each ministry and its agencies, local public entities, as well as public corporations and quasi-public agencies, have set up their own regulations as the necessity arose to deal with employee's inventions. Their systems of compensation money have also been organized. We shall touch upon some of the more important ones in another section.

B. Ways of Handling Patents and Inventions in National Universities

There has not been a clearly defined systematic opinion, nor a sufficient system of handling inventions of university professors. Therefore, the handling of university professors' inventions has been left mostly to each university to deal with independently. In national universities there are at present three ways of dealing with the situation when professors wish to obtain patents. First, there are cases in which university regu-

lations exist concerning the employee's inventions. In this case, if the inventions qualify as the employee's inventions according to the regulations, the right to the patents belongs to the nation, and the patents are treated as government-owned. The second case is that when there are no regulations in the university covering employee's inventions, the inventor, by his own initiative, transfers the patent rights to the national government. As a result the patent right becomes government-owned. Third, there are inventions which do not fit into either of the above categories and therefore are treated as free inventions.

1. Universities and Research Institutions with Their Own Regulations

At present, national universities whose regulations include provisions on the employee's inventions consist of one university and five university institutes. Moreover, the dates of their enactment are very old; they all belong to the period when the Old Patent Law was in effect.

December 1, 1922

Enactment of regulations concerning inventions, utility models, and related matters for the staff of the Research Institute for Iron, Steel, and Other Metals of Tohoku University (revised March 21, 1940).

July 24, 1930

Resolution of regulations concerning invention, utility models and related matters for the staff and researchers of the Institute of Infectious Diseases, of the University of Tokyo.

December 27, 1937

Enactment of regulations concerning the handling of industrial properties of Tokyo Institute of Technology (effective January 10, 1938).

November 6, 1941

Enforcement of regulations on inventions of the Engineering Research Institute, Faculty of Engineering, of the University of Tokyo.

July 1, 1949

Enforcement of regulations on the employee's inventions for the staff of Research Institute for the Scientific Measurement of Tohoku University.

September 22, 1949

Enforcement of temporary regulations on the employee's inventions of the Institute of Industrial Science of the University of Tokyo.

Although these six regulations are somewhat different in form, they all comply with provisions of the Old Patent Law, giving the right of succession to the university or the institute when inventions fall under the employee's inventions. Namely, they stipulate that "the right to obtain a patent" is transferred to the university or the research institute when the staff of the said institute "made the invention in the institute in relation to his service," (the Research Institute for Iron, Steel, and Other Metals of Tohoku University, Research Institute for Scientific Measurement of Tohoku University, Institute of Medical Science of the University of Tokyo), or when the invention is made by the institution staff and it "belongs by nature to the institution's scope of service and actions leading to the invention according to its' staff's duties (Tokyo Institute of Technology, Engineering Research Institute of the Faculty of Engineering, The University of Tokyo). They state that the question of whether or not an invention is an employee's invention is decided by a committee organized within the university. These regulations remain almost intact except for minor revisions.

Even when universities have set up regulations on the employee's inventions, actual acquisition and effective enforcement of patents, according to the way universities handle them, cause many problems as discussed later. As a means of solving such problems, the Research Institute for Iron, Steel and Other Metals of the Tohoku University, for example, uses a juridical foundation. Since 1940, the Institute has been associated with the Association for Encouraging the Research of Metal, which has the aim of promoting research on metalic materials. They have tried to utilize effectively the institution-owned patent rights, paid royalty to the national government, and helped to promote the advancement of research on metalic materials by awarding subsidies to inventors. Success is due to the long tradition and the accumulation of basic research efforts aimed at utilization of inventions, as well as the many excellent inventions achieved by our predecessors which could be used. As will be discussed later, the foundation system has examples of success among American universities also.

2. *Universities and Research Institutions under the Jurisdiction of the Ministry of Education, Science, and Culture without Their Own Regulations*

Since universities may not have the right to acquire patents by prearrangement, patents for the inventions of professors (in national universities and institutions without regulations on the employee's inventions), basically belong to the individual inventors. When the inventions in question are the employee's inventions, the employer (namely the national government), receives only the non-exclusive license of acquired patents. However, since it is not appropriate for the national government to make a profit by utilizing its patents, we may say that no actual result can be expected from the national government's holding of the non-exclusive license. Therefore, when professors of uni-

versities without regulations on inventions actually produce inventions, the university cannot help but treat these inventions almost as free inventions.

On the other hand, however, there are cases of some university professors who transfer their inventions to the national government in expectation of public use or in accordance with administrative guidance of the government. All the national, government-owned patents, for the inventions of the professors in universities and institutions which do not have their own regulations, have been created so far solely through transfer. Once transferred, they become nationally-owned patents and are treated exactly like those belonging to the above-mentioned sub-section 1.

3. Other Cases

The handling of patents is extremely varied. It is hard to grasp its reality when inventions are made where there are no regulations governing the employee's inventions and when there is no transfer to the nation. There are cases in which individual inventors obtain and administer the patents. In other cases, inventors transfer the right to obtain patents or patent rights to foundations which administer those rights; or inventors retain the patents while setting up exclusive or non-exclusive licenses with private enterprises. Also, there are cases of obtaining the patent rights jointly, i.e., inventors and private enterprises. Improvement in management efficiency by reorganization in the interest of university professors is needed.

C. Reality of National University Professors' Patents

1. Patents Owned by the National Government

a. Number of patents. National government-owned patents (including foreign patents) for the inventions of national university professors totals 431 as of March 31, 1976. Tohoku University is first with 136 patents, including 116 patents for inventions by the professors of the Research Institute for Iron, Steel, and Other Metals. Osaka University has 109 patents; Tokyo Institute of Technology has 72 patents, and the University of Tokyo has 39 patents. The patent rights acquired by other national public service personnel total 3,492 and includes: 2407 for the Ministry of International Trade and Industry; 294 for the Office of the Prime Minister; and 193 for the Ministry of Agriculture and Forestry.

b. Procedure. Universities and institutions with their own regulations on the employee's inventions, begin their patent-acquiring procedure with the formation of a committee within the university to deliberate whether or not inventions in question fall into the category of employee's inventions. It is customary also, for the committee to decide whether the optional transfer of patents to the national government be accepted or rejected when such proposals are initiated by the inventor. If accepted, steps are taken for the acquisition of patents as nationally-owned. The procedure of obtaining patents today requires highly-specialized, expert knowledge and techniques. However, universities and institutions do not have such expert staff, which makes it necessary for them to hire specialists such as patent attorneys. Since the national government does not have a budget for applying for patents within the country, individual inventors or their universities or institutions bear the financial burden. After procedural steps within the university are completed, applica-

tions go to the Patent Office.

c. Administration. The administration of patent rights, after applying for or acquiring them, is complicated by international relations and relations with enterprises. However, there exists no organization for patent administration in the national government or in the universities, making it necessary for individual inventors, or their universities or institutions, to handle the matter. Also, in administering patent rights, it is actually necessary to do further research in related fields of technology concerning the development of the technology relating to the patent. However, there is no economic or systematic compensation designed especially for this purpose.

d. Profts, Among the domestic patents for inventions of university professors owned by the nation, 22 were worked as of March 31, 1976, making the working rate 7.7 percent of the total. The working rate for the total national government-owned patents is 9 percent. The breakdown of the figure by universities shows 10 for Tohoku University, 6 for Osaka University, 5 for the University of Tokyo, and 1 for Shizuoka, according to the Research Development Corporation of Japan. There are large profit producers such as the Osaka University Industrial Science Research Institutes' patent for a method of producing antibiotics such as cephalospolin acid, for instance, which amasses about 100 million yen a year in royalty.

e. Compensation. Compensation to inventors, compensation for registration, and compensation for exploitation are paid the same as to other national public service personnel in accordance with the notification of the Patent Office (the notification by the Director-General of the Patent Office dated March 13, 1975, "On the Formalities of Demanding the Payment of Compensation and the Procedures of Payment Regarding Employee's Inventions of the

National Public Service Personnel" and "The Purport of Payment of Compensation to Employee's Inventions of the National Public Service Personnel"). Compensation for registration has been established by law as 3,000 per yen per invention; compensation for exploitation has been established on a scale according to the results of the income, but up to 1,500,000 yen per person per year.

f. Budgetary measure. The budget, which the national government (the Ministry of Education, Science and Culture) approves for the various expenses connected with government-owned patents for the inventions of university professors, has shifted about 14,000,000 yen since 1970. Out of said budget, the allocation for filing patent applications in foreign countries is estimated to be 10,000,000 yen. A fee of several hundred thousand yen presently is charged in order to file a patent application in a foreign country. It is possible to file a patent application in less than twenty countries a year keeping within the limit of the budgetary appropriation. Therefore, there is no alternative but to file an extremely limited number of patent applications in foreign countries. This cannot help being considered insufficient from the viewpoint of the defense of domestic techniques and the export of our techniques.

2. Patents Privately Owned and Patents Jointly Owned with Enterprises

It is hard to comprehend how university professors as inventors deal with their patents except those which are transferred to the government. Excepting those privately owned patents which have been exploited from the viewpoint of effective utilization of the results of scientific research and, in a wider sense, of technological advancement of the nation and promotion of industry, it is regretable that patents of university professors are unnoticed due to the lack of an effective system.

Many inventions of university professors are made at the request of enterprises, etc. The ownership of industrial properties arising from said inventions by national university professors, is clearly defined by the stipulation, "When industrial properties or other forms of right are created by commissioned research, those rights may not be transferred or permitted to be used without compensation" (the notification to national university presidents, April 30, 1970, "Concerning the Handling of Commissioned Research"). When university professors make inventions with researchers of other organizations or with other individuals, patent rights of the said inventions are believed to be of joint ownership.

D. Municipal and Private Universities

No municipal university has its own regulations governing employee's inventions. Instead, regulations governing employee's inventions made by the staff of local public entities, i.e., founders of those universities, are being applied to them. For instance, the prefectual governments of Tokyo and Osaka, and the city government of Osaka, have their own regulations established in the form of ordinances and regulations govering employee's inventions. These regulations are applied, respectively, to inventions made by the professors of the Tokyo Metropolitan University, the Osaka Prefectural University, and the Osaka City University. With the latter two universities, several instances of employee's inventions have taken place.

There are few private universities with their own regulations concerning employee's inventions, such as Tokai University and Shibaura College of Engineering. Most private universities allow their staff's inventions to remain basically free, except those done through commission, and it is extremely rare for them to own patent rights. Waseda University, for instance, requires

separate regulations to define the use and ownership of copyrights and rights of inventions resulting from reserach done in that institution. The regulations are yet to be organized; nevertheless, applications for patents are filed each year in the name of its president. Tokai University is in the process of revising the existing "Regulations Concerning the Handling of Inventions resulting from Tokai University research projects are retained by the university after deliberation by an in-house committee. At Shibaura College of Engineering, according to its "Regulations Concerning Inventions Made by the Staff of the Engineering Research Institute," patent rights of the inventions made by the said research institute are retained by the institute. There have been several cases attesting to that fact.

III. WAYS OF HANDLING PATENTS IN OTHER RESEARCH INSTITUTIONS AND AN OUTLINE OF UNIVERSITY PATENTS ABROAD

A. Ways of Handling Patents in National Institutions for Experimentation and Research

Research institutions, which bear the burden of research development in Japan, include (beside scientific research institutions of universities), national institutions for experimentation and research, research institutions of public corporations, and private enterprises and their research institutions. However, here we will examine, especially, the reality of handling patents in national institutions for experimentation and research, and research institutions of special corporations.

Each national institution for experimentation and research has its own regulations concerning employee's inventions which obligates its staff to file considerably extensive reports on their inventions. According to the rules, national institutions

decide whether or not reported inventions are, in fact, employee's inventions and, if so, whether or not the institution will take over the right of acquiring patents. The Science and Technology Agency and the Agency of Industrial Science and Technology, for instance, have established rules on employee's inventions and devices covering institutions for experimentation and research under respective jurisdiction, categorizing those inventions of the institutions' staff made in the line of their duties as the "Employee's Inventions." These fall into the fields of work of the institutions to which the inventors belong as the "Inventions in Service." In both categories, staff inventors are acquired to file a report of their inventions, which are discussed to decide whether or not they should be transferred to the national government. In this process, a committee is formed, in the respective sections, to be consulted during the deliberations.

These institutions have some staff members who specifically deal with the paper work of patents. However, the help of specialists is needed often, such as when patent attorneys are requested to file applications for those inventions which have been designated to be transferred to the national government. The government, dealing with exploitation and administration of patent rights, either grants licenses (directly to the licensee such as enterprises), or grants exclusive licenses (to corporations or foundations specialized in exploitation and administration of patent rights, leaving the use of the license up to them). In the cases of inventions transferred to the government, compensation for registration and compensation for exploitation are paid in accordance with the notification of the Director-General of the Patent Office.

Research institutions of public corporations, as in the case of national institutions of experimentation and research, require filing reports on inventions in accordance with their regulations concerning inventions made by employees or with their work rules. Judgments are made on those reported whether or not they fall

into the area of an employee's invention and whether or not they should be transferred to the employer institutions. Here again, filing applications for patents is mostly handled by outside specialists. Payments of compensation for exploitation are considerably different among corporations, but in general they are higher than the level of payments by the national government.

The public enterprise systems and procedures for patent acquisition and administration are more more organized. The Musashino Electrical Communication Laboratory of Nippon Telegraph and Telephone Public Corporation, for instance, has established an Information and Patent Division which continuously collects information concerning patents within Japan as well as abroad. They take speedy steps regarding inventions within the corporation.

Local public entities have established regulations governing an employee's invention in order to meet the need of administering their own staff's inventions.

B. Systems and Functions of Patent-Related Agencies

Much of the work, such as patent application and exploitation and administration of patent rights (concerning inventions in universities and in institutions for experimentation and research), is being carried out through specialized public corporations and foundations.

For instance, a public corporation, the Research Development Corporation of Japan, established in 1961 for the purpose of effective development and dissemination of new technology, has as its main line of service the commissioned development of new technology and its introduction to business. In addition, this corporation engages in the procedures of patents. Among private foundations, the Japan Industrial Technology Association, organized in 1969, is active in the introduction, the dissemination,

and the propagation of employee's inventions made in national institutions for experimentation and research such as those under the jurisdiction of the Agency of Industrial Science and Technology.

Japan Engineering Development, Ltd. (JED) was established in 1967 for the purpose of filing applications for and administering mostly privately-owned patents in behalf of university professors. JED is performing a public service, in a sense, concerning the use of patents owned by university professors.

For nationally-owned patents, of national institutions for experimentation and research, exclusive license has been granted to public corporations or foundations specializing in the exploitation and administration of patent rights. These organs, in turn, try to sell those patent rights by giving the license to exploitation agencies such as business enterprises. Thus, in reality, these organs handle patent-related paper work on behalf of experimentation and research institutions. They perform the functions of exploiting and administering patent rights.

IV. PROBLEMS OF EXISTING WAYS OF HANDLING PATENTS

Existing ways of handling patent rights arising from inventions made by university professors in Japan are as described above. However, the reality seems replete with more numerous problems than in other organizations of universities abroad. Here we will examine those problems as we try to establish the proper policy for the future.

A. The Basic Problem

Today, in Japan, there are very few national universities and research institutions with well-defined patent-handling systems. Such patent-handling systems must clearly define the regulations which govern inventions made by employees in their line of service. The voluntary transfer of rights by inventors are often not defined. The national government has not established a unified and clear handling policy, nor has it taken positive steps toward the protection and utilization of university professors' inventions. As a result, there exists differences in ownership and administration of patent rights among universities and research institutions that cause disparity among university professors. Moreover, due to the lack of a smooth system, many inventions remain unpatented, many achievements are not reflected in industry, and, as a result, ideas of university professors are not widely distributed. This is a problem of prime importance.

An all-around solution to this problem has not been found for so long as the characteristics of universities, as scientific research organs, make it unsuitable for them to adopt the same methods used in the private sector. This poses a basic problem in the application of Article 35 of the Patent Law to universities.

B. Problems between Invention and Patent Acquisition

How should judgments be made and which organ should decide whether or not certain inventions by university professors qualify as employee inventions? Even when university rules exist or when transfer of rights are made voluntarily, problems remain. The formation of a committee within the university presents various problems as there is: 1) a lack of people capable

of understanding specialized subjects and able to make judgments as to the worthiness of inventions in highly specialized fields; 2) an ambiguity of criteria for the employee's inventions; 3) a time burden on committee members, difficulty in keeping secrecy, and difficulty in making quick decisions.

The filing of applications also requires a high degree of practical and specialized knowledge. Accordingly, under present situations when neither staff specialists nor budet for office expenses is available, the burden on individual inventors becomes excessive. It is also said that patents of university professors become "weak patents" because their universities lack personnel with the newest patent information and expert knowledge on exploitation.

The above problems seem to highlight basic differences in organization and character between private enterprises, where numbers of researchers in the same field interact and where staff members specialize in patent information, and universities, which are scientific research organs. In short, universities basically do not have a system capable of functioning freely and quickly to obtain patent rights.

C. The Problem of Administering Patents

Problems still arise in the administration of patent rights after patents are obtained. Universities, totally lacking a budget as well as a staff for patent management, are unable to defend their patent rights. Their patents are gradually eroded by the development of related patents and lose their effective value. The contact of private concerns to exploit patent rights and response to inquiries from abroad also place economic and time burdens on individual inventors. We often hear of a person who is unable to concentrate on new research after making an outstanding invention. We may call this a tragedy for the promotion

of scientific research.

In administering patent rights, universities have to give licenses to business enterprises, but universities are often not suitable judges of this. Furthermore, unlike private enterprise where an employee's patent for an invention is credited to them and might be reflected in promotion, patents in universities are not directly related with the merit system for promotion. It is advisable that a university professor's patent rights be evaluated not by the general criteria, but as part of all his scientific research achievements.

D. Problems Regarding Compensations and Research Subsidies

The next question is whether or not compensations are sufficient. In the case of national public service personnel, the maximum amount of compensation per person per year is fixed at 1,500,000 yen even if a person made more than two inventions and even if the license fees from his invention amount to more than 100,000,000 yen. This concept of a fixed ceiling needs to be reexamined.

Inventors, especially researchers at scientific research institutions such as university professors, aim at and are anxious to develop new technological ideas. Consequently, it is most desirable, increased compensation to individual inventors aside, to direct invention-related income to research funds. Therefore, we think it necessary to direct a part of the license fees to researchers to develop and establish the patent-related technology in order to take care of the patent rights in a true sense. In this sense, a budget for such research is a rather necessary expense.

Moreover, Japan's balance of trade in the field of technology today is four to one in favor of imports. This makes it all the more necessary for Japan to file more patent applications abroad,

and it is desired that steps be taken to make it less burdensome, financially, to file applications abroad.

V. CHARACTERISTICS OF SCIENTIFIC RESEARCH AND THE HANDLING OF UNIVERSITY PROFESSORS' PATENTS

A. Characteristics of Inventions and Patents in the Course of Scientific Research

Scientific research is basically a human activity based on the search for truth and a fundamental thirst for knowledge. We may say that its central objective includes the discovery of new laws and principles, the establishment of analytical or synthetic methodology, and the development of new fields of study by systematizing old or new knowledge and technology. At the same time, the results of scientific research do not remain within the field of abstract theory; the utilization and adoption of technology produce concrete results. Thus we may say that scientific research also plays a role in providing a material foundation which supports the daily life of human beings.

Nevertheless, scientific research does not directly aim at achieving such results as would probably lead to the acquisition of a patent. Herein lies the first characteristic in the relationship between scientific research and invention.

This first characteristic becomes clearer when the objective of scientific research is compared with the research objective of private enterprises' development projects or with the research objective of national institutions for experiments and research. The research and development of a private enterprise, generally aims at the production of a concrete product decided upon by such means as market research from the management's viewpoint. In many cases, the course of its research progress toward in-

vention, discovery, and patents is clearly foreseeable. National research institutions are sometimes engaged in more fundamental research, but their chief mission is to carry out research with fixed objectives appropriate to the aims of the respective agencies to which they belong. Thus we may say that they are more closely connected with inventions, discoveries, and patents than scientific research.

The second characteristic in the relationship between scientific research and inventions can be seen in the way the research subject and methodology are chosen. Basically, outstanding achievements should be expected from scientific research only when it proceeds with the free and unrestrained ideas of researchers as the fountainhead.

Truly creative research, with potential for far-reaching effects, is built on the ideology of freedom of studies as established by experience throughout the long history of mankind.

This ideology, then, and methodology of scientific research has always been decided upon by the researchers themselves. It has been the basic practice of a university professor to have the freedom to choose his own subject among the wide-range of research subjects in the fields of his lecture courses and of his specialization.

The way research is conducted in universities is fundamentally different from private enterprises. For instance, in private enterprise we often see researchers following instructions and directives within respective research set-ups.

On the other hand, it has become increasingly necessary recently to press forward with research projects planned from the viewpoint of science policies. This is necessitated by the need for large-scale and expensive research in such fields as nuclear fusion and cosmic science, or by the increasing needs of inter-departmental research embracing various specializations. In such cases, it is necessary to plan and carry out research projects synthetically in order to systematize research and to

enable effective use of available funds while maintaining, in principle, the freedom of study and accepting suggestions of researchers. Accordingly, research in these fields have an end in view. Moreover, in view of the special funds invested, it seems necessary to handle them differently from general scientific research in terms of the ownership of patent rights.

Next, it must be noted that those characteristics of scientific research outlined above are necessarily reflected in the resulting inventions and in the contents and nature of patents. Namely, university professors' inventions seem more theoretical than the technologically completed ones which are ready to be manufactured. In other words, among advanced technological concepts worthy of invention, university professors' inventions contain more of the theories and fundamentals and few of their patents can be exploited. Many of these patents seem to need extensive technological devices and improvements, in cooperation with private enterprises, before they can be put to practical use.

Another factor to be taken into consideration is a considerably strong tendency among university professors in Japan to obtain patents more for the purpose of securing the prior right of their research achievements rather than for economic gain. Japan lacks a system and a custom of honoring or guaranteeing priority of intellectual activities such as ideas, discoveries, and inventions. University professors tend to obtain patents as a means of self-defense in this sense.

These characteristics of patents in content and effectiveness suggest that inventions and patents arising from scientific research should not be treated solely from the viewpoint of industrial properties as one side of the economy, and that they should be considered, in a wider sense, as a part of researchers' achievements. In fact, some researchers in the engineering field are having their patents, along with scientific discourses, evaluated to gaining priority. It is believed that handling

patents from the angle of promotion for energetic research activities, which would result in the growth of theoretical discoveries and inventions and, in the end, cause far-reaching effects on society. This is because the mission of scientific research is to provide the basics for scientific technology, which is utility.

B. Interpretations of Existing Laws and Their Proper Application to Universities

Having examined the characteristics of scientific research and the resulting patents, it is now necessary to clarify the relationship between these characteristics and the patent system in Japan—especially that of employees' inventions and their relationship to the patents of university professors.

As described in Section II, the existing Patent Law as revised in 1921, favors inventors and allows employee-inventors to retain patent rights. On the other hand, the law gives certain rights concerning those inventions made by employees which fit the definition of "employee's invention," in due consideration to employers who helpd inventors directly or indirectly (Article 35, Patent Law).

This provision of an employee's invention seems intended to keep a balance or fairness between the interests of employees (inventors) and their employers.

The legal right given to the employer, in this case, is the non-exclusive license to exploit, as part of business, the patent of the said invention. The purpose of the present Patent Law is "to encourage invention and to contribute to the development of industry by protection and utilization of inventions." Therefore, the employee's inventions system, under the law, functions better among private enterprises. Non-exclusive license given to the national government and to public agencies of local public enti-

ties, in reality, seems to have little elbow room to work effectively.

The concept of an employee's invention, in effect, consists of two factors. First, the invention in question belongs to the employers "scope of business," and secondly, the actions of an employee leading to the said invention belong to his "duties" at the place of work, present or past. Regarding interpretation of the "scope of business," the limit of scope is extremely hazy when the employer is the national government or local public entities. In the case of scientific research institutes, such as universities, opinions differ as to what lies within the scope of work. According to the School Education Law, the purposes of universities are, "...centers of sciences, to spread knowledge widely, teach and study specialized fields of sciences and arts in-depth, and to develop the ability of intelligence, morality, and practical application" (Article 52). However, this provision which includes "teaching and studies" in all fields, seems too inclusive to define the scope of business. Moreover, it is questionable to say that "teaching and studies" naturally includes university professors' inventions.

Even if the "scope of business" in scientific research institutions, such as universities, is interpreted narrowly, it is more questionable in regards to university professors' actions on inventions as their work duties, when they are seen in light of the second factor in the concept of an employee's invention. That is to say, university professors are to "teach students, guide their research, or engage themselves in research" (Article 58). Education and research in universities are inseparable; education and research in universities are inseparable; education is based on research, and research is carried out in close relation to teaching and research guidance.

Again, as previously stated, when exclusively examining the way research is being conducted in universities, the research theme and its methodology are left to the researchers' initiative;

it is vastly different from the way in which the contents of works are decided by directives and orders.

Taking all of this into consideration, we must say that even when university professors' research results in inventions, it is not the natural results expected in the course of their duties. Rather, many inventions are intellectual products gained through research life or flashes of wisdom.

Thus we believe that there naturally is a limit in the application of provisions regarding employee's inventions for university professors in exactly the same way as researchers in private business enterprises or national institutions for experimentation and research.

C. The Handling of University Professors' Patent Rights

In view of the characteristics of ordinary university professors' research activities as described above, it is proper to rule that rights arising from these activities do not belong to the employer except in special cases. Regarding university professors' inventions, it is important to make judgments from the viewpoint of a far-sighted policy concerning what belongs to the employee and what belongs to the employer.

First of all, aims of universities are not to produce gain appropriate to investment but to promote education and scientific research. Accordingly, it is not necessarily the only way for the employer, such as the national government, to keep all rights arising from college inventions. The important thing is to choose the best way to handle those inventions in order to facilitate their speedy and effective utilization, to cause researchers to want to produce new ideas and, in the long run, to promote a thriving scientific technology in Japan. From this viewpoint we may question the transfer of all rights to the national government or universities while they do not have the

ability to acquire and administer patents speedily and exactly. This may result in a situation in which the application for patents for excellent inventions are not filed in Japan but are filed in foreign countries. Therefore, it seems more in keeping with our aims to let university professors keep the rights from their inventions, facilitate their speedy exploitation and, with the income from them, plan further development of their research.

As previously stated, there are special kinds of research done by university professors under special themes with clearly defined aims and with special research funds and equipment. Within such research, those clearly aiming at practical application may be regarded as work from the beginning. The resulting inventions should be treated as the employee's invention belonging to the employer. That is to say, rights of such inventions made by national university professors belong to the nation and those made by professors of municipal and private universities belong to the founder. It is advisable that those inventions carried out by national universities with the help of the Ministry of Education, Science and Culture's grants-in-aid be treated along the basic concept above. When regarded to be the employee's invention patent rights should belong to the nation. In the cases of municipal and private university professors' inventions corresponding to those described above, additional provisions should be defined as to the rights that the national government reserves for the non-exclusive license.

Legally speaking, it is necessary to have contracts, work regulations, or other rules established in the event of an invention made by an employee (a university professor), so it will be treated as an employee's invention, the right to which belongs to the employer. So it is necessary for each university to have its own established rules concerning employee's inventions. It is also desirable to establish the custom of clearly defining ownership of the rights upon the signing of a research contract as in other countries.

Described above is the way an employee's invention, whose ownership belongs to the employer, is handled, but university professor-inventors often voluntarily surrender their patent rights. This reflects their desire to have their rights o inventions utilized by the public rather than keeping them to themselves. Therefore, it is necessary to improve the method for the voluntary transfer of patent ownership from individuals to the nation, local public entities, or school foundations, in line with the system designed to utilize employee's inventions that are owned by employers.

The next problem concerns patent ownership for university professors' inventions resulting from commissioned or joint research. In the case of joint research, it is desirable for the partners to hold the rights jointly, each share being determined in proportion to the amount of the contribution toward the invention. When a university professors' invention is an employee's invention whose ownership belongs to the employer and which was done in cooperation with researchers of private enterprises, the patent rights are held jointly by the employers on both sides, each holding a portion at a rate agreed upon by the researchers. When inventions are made as a result of commissioned research, the sources of research funds, the contents of the research, and the contributions made by commissioned researchers must be taken into account; decisions are made on a case by case basis. The best method in such cases is to have patent ownership defined clearly upon conclusion of the contract. It is necessary for the national government and local public entities to find an easier way of handling patents jointly owned with private enterprises and of granting licenses for exploitation.

International joint research causes more difficult problems in relation to patent ownerships. Because of the differences among nations in technological advancement leading to inventions, problems become more complicated. In most cases, however, various agreements are made concerning the handling of patents upon the

conclusion of contract.

VI. SYSTEM FOR HANDLING PATENTS OF UNIVERSITY PROFESSORS

When speaking of how to handle university professors' patents, it is necessary to formulate the most effective and appropriate system of management and utilization based on the characteristics of scientific research inventions and fundamental concepts on university professors' patents. At this point, it is important to do so from the standpoint of protection and utilization of patent rights as well as for the promotion of a wide-range of scientific research. In concrete terms: the procedure for patent acquisition must be simple and speedy; a system for the effective use of patent rights must be designed; the will of researchers must be strengthened; the acquisition of patent rights must be connected with the accumulation of research funds; and patent rights, especially of national university professors, must be properly managed as national properties. For these purposes, a consistent system must be established for handling inventions from their conception to exploitation of patent rights and distribution of income from them.

A. Proper System for Management and Utilization of Patents

In order to establish a system which is most effective in a series of processes (including birth of an invention, identification of an employee's invention whose rights belong to an employer, filing of an application for patent, exploitation of patent, and distribution of its income), there first must be a clear division of functions between those handled within a university and those handled on a national scale because of the limited university ad-

ministration; then a system must be established where those functions work together as a network.

1. System within Universities

First, it is necessary to determine whether or not the professor's invention is an employee's invention whose rights belong to the employer and whether or not the founder of the university, such as the national government, should accept voluntary transfer of the invention. For this purpose it is necessary to establish school rules governing inventions. Although school rules should be established by each university, it is necessary for the Ministry of Education to define the unified national standard (see Section VII), to be referred to by each university when formulating its own school rules to avoid deviances among universities.

Next, it is desirable to establish a body, such as a committee on inventions, to make concrete judgments. Among the factors to be considered are the size of the university, the characteristics of the field of specialization, and whether or not it is a research institution. The size of the committee should be in proportion to the size of the university. These committees should be established in every university, department, and institution. Several small universities might be served by one committee.

In order for us to give recognition to inventions as achievements of scientific research and to plan utilization of them in society, it is necessary to perfect these systems within the university. It is also desirable to make it a rule for professor-inventors to report to the university in some manner. When such a report if filed, it should be examine, a patent should be obtained, and it should be used to gather information concerning research achievements. At the same time it is important to consolidate the administrative systems within the university in order to gather information, manage committees, and be in contact with the central patent system.

2. The Central Patent System

As to those inventions which are determined to be employee's inventions whose rights belong to the employer, work, such as filing applications and management and exploitation of patents, should be handled by specialized organs established outside the university. Such organs could be public corporations, foundations, etc., but in view of financial soundness and business efficiency, those capable of operating on a national scale, are desired. In order to handle this work from the viewpoint of the promotion of science, it is considered appropriate for the Japan Society for the Promotion of Science to function as the central system. Regarding promotion of utilization or exploitation of these patents, which would be processed by the central system, we hope that the work would be done in close cooperation and be shared with existing systems for the promotion of technology.

It is desired that the central system not only be responsible for obtaining patents but also for compiling research information, in a broad sense, regarding the patents and know-how of various foreign countries, and the patents of administration and exploitation of patent rights and other business. For this purpose, the central system would be required to hire the necessary staff specializing in each technical field or be required to reorganize both systematically and financially. The central system should appropriate the funds required for obtaining patents at govern-cost and, in the future, to provide the same services for private patents of the staff of national universities and municipal and private universities and colleges respectively, at the cost of patent right owners.

It is desirable that the committee, expected to be set up by each university and research institution to handle patents, operates hand in hand with the central system. Both systems should be complementary.

B. Proper System of Compensating Researchers and Research Organizations

The license fee for government-owned patents belongs to the national government, and a portion of the fee can be given to the inventor as compensation. In the case of privately-owned patents, the fees go to the individual inventors. In this sense the existing limits of compensation in relation to nationally-owned patents need to be re-examined. By the same token, in cases involving university professors' inventions, steps should be taken to adopt a policy for redirecting the fees to their research funds. That is to say, the primary objective of obtaining patents by university professors is securing priority and their demands for personal economic compensation is secondary. Therefore, it is strongly hoped that, as already practiced in American universities and at the Tohoku University in Japan, a portion of the license fee is redirected to the inventors' research fund so that it may be used to further research. It is highly desirable to promote the inventions of university professors by redirecting the fees to the research fund and thereby facilitating inventions with broad, far-reaching effects for the future of Japan.

For this purpose, in the case of national government patents, a part of the fee should be given as a reward to the university professor-inventor or to the research organization of which he is a member.

In handling cases of utility models, it must be done in accordance with the above. Although we examined the ownership of industrial properties arising from university professors' inventions, the same treatment should be accorded to the technical staffs engaged in research activities in scientific research institutions of universities and colleges.

Based on the fundamental concepts described above, we have systematized the handling policy of patents and similar matters which should be adopted by the national government, including the

systems of patent handling for individual universities, in Section VII.

VII. PROPOSED STANDARD FOR THE HANDLING OF PATENTS AND SIMILAR MATTERS FOR THE INVENTIONS OF UNIVERSITY PROFESSORS

Purport

Article 1. This standard defines fundamental items concerning the handling of patents and similar matters in relation to inventions made by university professors, and thereby plans the use in society of the results of scientific reserach in universities and helps to promote a wide-range of scientific research relating to inventions.

Definitions

Article 2.

1. The term *universities* in this standard designates that which is stipulated in Article 1 of the School Education Law (No. 22, 1947), and it includes the National Inter-university Research Institutes as provided in Chapter 3, Item 3 of the National Educational Institutions Establishment Act (No. 150, 1949).

2. The term *professor* in this standard designates university presidents, professors, assistant professors, lecturers, and assistants.

3. The term *invention* designates those of high standard among creations of technological ideas utilizing natural laws.

On-Campus Provisions

Article 3. Depending on actual circumstances such as size, nature of specialization, and existence or non-existence of research institutions each university, faculty, or institute should reorganize its on-campus provisions for the handling of patents and similar matters of inventions made by its professors in accordance with Articles 4, 5, and 5 of this standard.

Criteria and Transfer

Article 4. As to the rights to obtain patents or patent rights (hereafter referred to as rights of patent) for inventions made by professors of the university, inventors of those inventions belonging to one of the following must apply for transfer to the founder (meaning country, local public entities, or school foundation):

1. An invention resulted from research which received special research expenses from the founder and was conducted under a specific research topic for the purpose of its application and development.

2. An invention resulting from research for the application and development using special equipment set up by the founder for special research purposes.

3. Those professors who made the invention stipulated in provisions above must transfer its rights to the founder when the president of the university decides that the rights of the patents and similar matters arising from the said invention belongs to the founder according to the provision in Article 3, item 3.

4. Those professors who make an invention other than those stipulated in the first item can apply for the transfer of its

rights of patent to the founder.

5. The handling of rights of patents resulting from research conducted with subsidized money, contributed money, or commissioned from those other than the founder, or research conducted jointly with outside university researchers, is to be decided in accordance with the condition of the subsidy, contribution, or research contract.

6. When the founder receives the rights of patents, compensation should be paid under a separate settlement.

Universities System

Article 5.

1. The university should form a committee on invention to discuss the basics in handling university inventions and ownership of the patent rights arising from inventions made by professors of the university.

2. When a university professor considers the results of his research worthy of invention, he must report immediately to the president of his university according to a separate provision. In this case the said professor may file an application for a patent himself.

3. When a report on an invention is presented to the university president, he decides whether or not the said invention fits the provision in the first item of Article 4, based on the opinion of the committee on invention, and whether or not the founder himself accepts those inventions which were determined to fit the provisions of those applied for as voluntary transfer.

The Central System

Article 6.

1. In order to handle in concentration such office work as acquisition, exploitation, and administration of patent rights for inventions made by university professors, and in order to make the handling system speedier, simpler, and more precise, the national government is expected to reorganize the central system.

2. The central system is to be established within the Japan Society for the Promotion of Science and will engage in the following activities, ordered by universities and others, on a commission basis:

a. filing applications for patents;
b. administration of patent rights;
c. exploitation of patent rights; and
d. gathering and disseminating information on inventions and specifically-related matters.

3. Any other development necessary for the exploitation of patents should be handled by other suitable agencies.

Other

Article 7.

1. Those who are in charge of the office work concerning the handling of university professors' inventions must dispense their work immediately. At the same time they must also maintain secrecy as to the contents, and all other related matters, of inventions.

2. This standard is applicable to utility models.

3. This standard is applicable to patents and similar matters for inventions made by members of the technical staff who engage in research activities.

LIST OF NATIONAL COUNCIL OF SCIENCES MEMBERS (in order of the *katakana* syllabary)

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°Ishii, Ryōsuke	Professor, Senshū University, Faculty of Law
Ito, Masami	Professor, the University of Tokyo, Faculty of Law
Inada, Kenichi	Professor, Osaka University, The Institute of Social and Economic Research
Osawa, Fumio	Professor, Osaka University, Faculty of Engineering Science
Okamura, Sōgo	Professor, the University of Tokyo, Faculty of Engineering
Okamoto, Michio	President, Kyoto University
Kishida, Junnosuke	Editorial Writer, the Asahi Shimbun Co.
Kimura, Shigenobu	Professor, Osaka University, Faculty of Literature
Kira, Tatsuo	Professor, Osaka City University Dean, Faculty of Science
Kuno, Hiroshi	Professor, Keio University, Faculty of Engineering
Kubo, Ryōgo	Professor, the University of Tokyo, Faculty of Science
Saito, Tadashi	President, Tokyo National Museum

Saiki, Kiichi	President, Nomura Research Institute
Sasa, Manabu	Vice Director, the National Institute for Environmental Studies
Shinohara, Miyohei	Professor, Seikei University, Faculty of Economics
Sugi, Jirō	Director, Japan Society for the Promotion of Science
Takahashi, Hidetoshi	Professor, Keio University, Faculty of Engineering
Tanaka, Nobuyuki	Professor, Tohoku University, Faculty of Science
Nagakura, Saburō	Professor, the University of Tokyo, The Institute for Solid State Physics
Nagata, Takeshi	Director, National Institute of Polar Research
Nasu, Noriyuki	Professor, the Univeristy of Tokyo, Ocean Research Institute
Nishi, Yoshiyuki	Professor, the University of Tokyo, Faculty of General Studies
Fushimi, Koji	Professor Emeritus, Osaka University and Nagoya University
Mizushina, Tokurō	Professor, Kyoto University, Faculty of Engineering
Mukaibō, Takashi	President, the University of Tokyo
Motoaki, Hiroshi	Professor, Waseda University, Faculty of Literature
Yamamura, Yuichi	Professor, Osaka University, Faculty of Medicine
*Yoshiki, Masao	Professor Emeritus, the Univeristy of Tokyo
Watanabe, Itaru	Professor, Keio University, Faculty of Medicine

**Council Chairman;* *°Vice Chairman*

NATIONAL COUNCIL OF SCIENCES: SPECIAL COMMITTEE ON PATENT

MEMBERS (in order of the *katakan syllabary*)

Aomi, Junichi	Professor, the University of Tokyo, Faculty of Law
Ito, Masami	Professor, the University of Tokyo, Faculty of Law
*Ogata, Shinichi	Former President, Japan Scholarship Foundation
°Okamura, Sōgo	Professor, the University of Tokyo, Faculty of Engineering
Kuno, Hiroshi	Professor, Keio University, Faculty of Engineering
*Saito, Shinroku	Professor, the Tokyo Institute of Technology, Research Laboratory of Engineering Materials
Sugi, Jirō	Director, Japan Society for the Promotion of Science
*Someno, Yoshinobu	Professor, Nihon University, Faculty of Law
Tanaka, Nobuyuki	Professor, Tohoku University, Faculty of Science
*Toyosaki, Mitsue	Professor, Gakushūin University, Faculty of Law
*Nakayama, Nobuhiro	Assistant Professor, the University of Tokyo, Faculty of Law
*Yugawa, Yasuhide	Professor Emeritus, Osaka University
*Yoshifuji, Kōsaku	Director, Research and Training Center for Industrial Property of Japan Institute of Invention and Innovation
Wada, Masanobu	Professor, Tohoku University Faculty of Engineering

**Specialist Committee Member;* °*Chief Examiner*