
THE *American* PATENT SYSTEM

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An Economic Interpretation

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CHAPTER I

INVENTION

THROUGH the ages, men have improved their standard of living by inventing methods of using more effectively the resources at their disposal. Organized society has recognized the significance of this activity, and as an encouragement to invention has developed a concept of property rights known as the patent system. Frequent attention is focused upon the American patent system by widely publicized charges and countercharges regarding its effectiveness as an incentive to the efficient production and distribution of goods. Discussion of the matter persists in peace and war. At one time it is alleged that the patent system has fostered the growth of monopolies, with all the attendant consequences. At another it is suspected that patents, in the hands of enemy nations, have been a device for reducing the fighting efficiency of the United States.

The patent system was designed to assure the development of new things which would react favorably upon the American economy. It is therefore to be considered as a *means* adopted to "promote the progress of science and useful arts." In this examination and re-appraisal of the economics of the American patent system, the desired *end*—encouragement to invention—claims first attention.

Definition of invention. The term "invention" is used in

several different ways, the two most frequent of which are to be noted. First, it may refer to the thing invented, as the airplane, or steamboat, or typewriter. This meaning is well sustained by popular and technical usage. Everyone is familiar with such a statement as, "The radio is a marvelous invention." In the same sense the word may be used to designate a method of accomplishing a result, such as mechanical refrigeration, or printing, or the flotation process used in refining certain mineral ores. But for the present purpose there is a second and more important usage which has reference to the mental activity or processes involved in developing new ideas. So conceived, invention must, of necessity, precede the thing invented. One would believe that radios, typewriters, steamboats, and airplanes could be assured a people if there were some certain way of keeping their mental activities functioning at a high level.

The fundamental concept underlying all invention is novelty. Invention involves the process of bringing forth some new idea which, when reduced to practical usage, will satisfy some want or desire, either latent or previously experienced. In this sense invention need not necessarily be limited to developments in the physical sciences or industry; it embraces all new developments. Invention is, then, a term that might be used when referring to all creative intellectual endeavor, whether it be new painting, sculpture, literature, music, or the search for new truths in the social, biological, or physical sciences.

Such a broad concept of invention follows naturally from the usual dictionary definition, which might be summed up into "the act of inventing," the definition of *invent* being "to find out by original study or contrivance." The dominant element is originality or novelty. Just what constitutes originality is difficult to ascertain, and when that question is con-

sidered by the United States Patent Office before granting a patent each case is decided on its merits.[1]

As for determining invention on the basis of novelty, consider the following passage:

> In this sense [of newness or novelty] invention embraces nearly all of human activity. It is not necessarily limited to developments in the physical sciences or in the industries, as it is ordinarily assumed. The term invention embraces all new developments in the social, administrative, business, the technical, scientific, and esthetic fields. It is applicable to all constructive intellectual work such as a new picture, statue, novel, poem, or song, and a new scientific method or theory, a law which will result in a useful economic or social effect, a legal system or government, a scheme of advertising or doing business, a new system of banking or finance, a method of teaching children, a new machine, a new chemical process, a system of philosophy. We do not ordinarily designate new developments in the social, esthetic, administrative, and business fields as inventions. This term is usually confined by most people to the technical field such as a new machine or process and it is very often identified with patented inventions, but as it has been just pointed out, the word has a much broader scope in its meaning.[2]

A similarly broad concept of invention was recognized by Arnold Plant when he said, ". . . invention is the devising of new ways of attaining given ends. We might widen the definition still further, by including the devising or suggesting of new ends themselves as inventions. . . ." [3] This last suggestion is wisely rejected, however, as departing too far from popular usage. It is to be desired that popular and tech-

[1] There are, however, general principles by which patentability is determined. These will be considered below.

[2] Joseph Rossman, *The Psychology of the Inventor* (Washington, D.C.: The Inventors Publishing Co., 1931), p. 8.

[3] Arnold Plant, "Economic Theory Concerning Patents for Inventions," *Economica*, Vol. I (February, 1934), pp. 32–33.

nical definitions be kept in substantial agreement, if possible, especially in the fields of the social sciences. To do otherwise confines the effectiveness of specialized monographs to those within the given field, while it is important to reach a very broad group of readers throughout society if the study is to exert any appreciable influence. That his meaning be not misunderstood, Mr. Plant would define invention as the devising of new ways of attaining given ends, but in order to make the "given ends" as concrete as possible he would exclude from the category of "invention" any change in consumer tastes.[4]

To clarify further the meaning of invention, note the distinction that Sir Josiah Stamp draws between discovery and invention.[5] Discovery consists of a tangible increase in man's knowledge of nature and its complexities. Discovery is a result of man's search for truth in the absolute. It is the product of pure research—basic research—which is a search for the explanation of the unknown. So far as man's activity results in a more complete knowledge of his environment, that revelation is properly termed discovery. Likewise, new knowledge of man himself, whether it be of a biological, or psychological, or sociological nature, is properly called discovery. Discovery, then, is a determination of principle, an explanation of something previously unexplained, an increase in man's knowledge.

Discovery is a mental process—it begins and ends in the realm of the mind. Discovery need not result in any material application of the newly found knowledge—indeed it cannot. As soon as there is conception of something material and practical, the realm of discovery has been forsaken for that

[4] *Ibid.*, p. 33.

[5] Sir Josiah Stamp, *Some Economic Factors in Modern Life* (London: P. S. King and Son, Ltd., 1929), p. 92.

of invention. Invention then consists of the application of known principles of knowledge to new facts, situations, or materials, in order to achieve some practical result. The result need not be too practical, however, for the only criteria by which practicality can be judged is utility, or capacity to satisfy a desire, regardless of how frivolous that desire may be.

As a basis for further consideration it is well to sum up the above discussion and to reduce it, so far as possible, to a concise and workable definition of invention. In doing this the qualifications that have been recognized must be given consideration. For the purpose at hand invention may be defined as the application of recognized (but not necessarily understandable) principles to inanimate subject matter for the accomplishment of desired ends, either the ends desired or the means of achieving them being characterized by some degree of novelty. In addition, the word invention will be used to refer to the product of the inventive process. This will seldom lead to misunderstanding, as the context will make the meaning clear.

Classification of inventions. The importance of the inventive process depends upon the "end result" of that process. Sometimes the result satisfies a very intense want of a large number of people, while in other cases it has but little utility, in the social sense, and may have want-satisfying power only for the originator or inventor. On the basis of the importance of the result, inventions may be classified as follows:

1. Basic or extensive invention
2. Developmental or intensive invention
3. Minor invention

These distinctions, which are now to be developed, are important and should be kept in mind. It is sometimes suggested that the patent system should recognize the varying impor-

tance of different classes of inventions, and that each class should be treated differently in order to achieve the maximum social benefit. Such provisions are attempted in the patent structures of some of the foreign countries, notably in those of Germany, Italy, and England.

1. Revolutionary results flow from basic or extensive inventions. The invention of written language, printing, telecommunication and explosives must be considered in this group, at least now that it is possible to view the effects with the advantage of hindsight. At the time that such great developments are first presented to the public they usually are deprecated and undervalued, and the inventor is considered as either a harmless tinker and dreamer, or a dangerous heretic to be suspected and shunned.

2. Inventions like those mentioned above, crude though they may have been, have gradually been improved until the results are as known today. The original inventions were of such a basic and extensive character as to be subject to all manner of further development and improvement by those who later applied themselves to the task. The invention of printing was a development of great merit, but only by the intensive application of the knowledge subsequently available to inventors, following the pattern of Gutenberg, has it become possible to make printed matter of high quality available to the masses of the people.

Most of the invention at any given time is probably of the developmental or intensive type. There is a limit to the number of basic inventions that can be made, but there is hardly any conceivable limit to the additions or improvements that may be appended to a line of development once it is under way.

Most inventions today are the improvement or intensive inventions which add to or improve the existing inventions.

They may be made by systematic research and investigation. The numerous improvements made in the industries, such as labor-saving machinery or machines to increase the output of goods, usually fall in this class. They merely improve and intensify the results begun by the basic invention. Improvement inventions are chiefly due to competition in industry. The desire to produce better and more efficient devices brings about many refinements, additions or eliminations of the basic invention which is usually very crude when first invented. Improvement inventions are thus transformations or natural evolutions of the basic inventions.[6]

3. Minor inventions result in the production of gadgets, of which there are many. A large number of present-day inventions, if we may judge inventions by the patents that issue from the United States Patent Office, are of this type. Socially, such inventions are of distinctly minor importance, though they are of great consequence to the inventor, at least during the first rush of enthusiasm that besets him upon becoming an inventor.

The most important class of inventions is, of course, that which has been designated as basic or extensive. This may not appear to be true at the time inventions are made, since there is no standard for judging. After a period of time, however, the innovations can be seen in their entirety, and the basic inventions are set apart by their importance.

Effect of inventions. Basic inventions, once introduced to the public, result in a greater variety of goods. Basic inventions are real innovations, considering that term in its broadest sense. They present something new, so that consumers, when able to adapt themselves, can satisfy a greater variety of wants, so far as the invention is not a substitute for something already extant.[7]

[6] Rossman, *The Psychology of the Inventor*, p. 15.

[7] Getting people to recognize new wants and to act upon them is not

Basic inventions have a further effect which is of especial importance when their reaction upon the functioning economy is considered. There is an increased demand for the necessary productive factors as the new good is adopted into the consumption patterns of the community. Because of this effect such inventions are often referred to as "labor-creating." It is meant that introduction of the new industries requires more laborers than would have been needed without invention. The effect is felt not alone in the labor market, but also in the capital market and in the markets for all the various types of raw materials that enter into the production of the good.[8] Such is the effect upon the functioning economy, and it is in these terms that economic progress must be defined.

Economic progress consists of the approach toward the full and efficient use of the factors of production, with the subsequent equitable distribution of the product. It should include the most efficient use of the factors from a social viewpoint; but, when one pauses to reflect upon the functioning of the existing economy, it is realized that such efficiency as is achieved is quite remarkable. Society has been wont to rely upon the functioning of the automatic economic forces to direct the economy. The automatic forces might do very well if allowed a reasonable opportunity, but man-made barriers have been erected to prevent their operation.

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invention—it is the changing of institutions. Advertising often helps to accomplish the change necessary to introduce a new invention.

[8] The introduction and extension of railroad transportation necessitated the direct employment of much labor, capital, and land. Even greater quantities of productive agents found employment indirectly. Similarly, the development of the electric trolley and its application to urban transportation resulted in a greater demand for the factors. Again, the application of the principles of electricity to the production, distribution, and utilization of power resulted in a net addition to the demand for the productive agents.

The tariffs, artificial price controls, regulatory bodies, monopolies, et cetera, are examples. There is, therefore, but small assurance that the factors will be used to the maximum social advantage. Rather, they will be used to satisfy those wants and desires that are best supported by purchasing power, irrespective of social need. So long as the economy is recognized for what it is, rather than as what it might or should be, a practical concept of progress must be adopted.

It should be held in mind that the announcement of a basic invention will seldom be followed by the immediate expansion of the economy. There is a lag between a new development and its assimilation into the general standard of life. The lag extends over a considerable period of time. Witness the slow adoption of the automobile on the present extensive scale after it was proved technically feasible. Witness the slow development of the airplane from the day of the Wright brothers' first flights at Kitty Hawk. Regardless of the reasons for the slow acceptance of new inventions, the point here to be recognized is that new basic inventions need not, indeed likely will not, greatly disrupt the functioning economy. This conclusion is in agreement with a statement by Sir Josiah Stamp that "Economic progress is the orderly assimilation of innovation into the general standard of life." [9]

Basic inventions that do not displace previous developments effect an absolute addition to the economy. There is a second type of basic invention that may not have the same effect—the completely new development that supersedes an already existing good, as the incandescent lamp did the oil lamp. It is likely that the widespread adoption of such improvements will displace the older devices, but not so sud-

[9] Sir Josiah Stamp, "Must Science Ruin Economic Progress?" *Nature*, Vol. CXXXII (September 16, 1933), p. 429.

denly as to cause any extremely serious disruption of the economy. There will be a shrinkage of one industry and an expansion of the other, but it is unlikely that serious problems will be generated. A displacement is effected, but in all probability there will be a net addition to the economy. Evidence to this effect is found in the report of the Commissioner of Patents for the year 1891. The sewing machine must certainly be considered a basic invention and one that likely would displace a considerable number of tailors. It was developed and put into extensive use between 1850 and 1870. Yet in 1870 there were in the United States 20 per cent more tailors in proportion to the population than there were in 1850. In spite of any displacement that may have occurred, there was a net addition to employment which must have been accompanied by a greater demand for the other factors.

It thus seems justifiable to conclude that basic or extensive invention is a force promoting economic progress; it is a force that leads to an expanding economy. Consequently, in order to achieve the maximization of social benefits, such invention should be especially nurtured by society and given every possible advantage in the artificial institutions that society builds about itself. Can the same be said for developmental or intensive invention? Attention is now directed to that problem.

A very great portion of the inventions being made today are developmental inventions. They are merely an intensification of the application of known principles to the desired ends. As illustrations of this type of invention the self-starter for the automobile, the cracking process in the refining of gasoline, and the automatic loom for cloth production can be cited. Such inventions are often characterized as being "labor-saving" or "labor-displacing," and as such are condemned by shortsighted investigators. It would seem more

accurate, however, to speak of them as "resource-saving" or "factor-saving" inventions.

There appear to be two subtypes of developmental inventions. One subtype results in greater efficiency; the other is directed toward satisfying more completely an existing want. Thus, of the illustrations noted above, it could be said that the automobile self-starter serves to satisfy an existing want—a means of starting the automobile—more completely. The "armstrong starter"—the crank—was the previous means of inadequately meeting the need. The self-starter increased the satisfaction that might be derived from an automobile.

The social desirability of inventions of this type must turn on their direct want-satisfying power or utility, and in the economy as it exists in practice only those that do satisfy such desires continue to be produced. It does not follow, however, that all the socially desirable inventions of this type are produced. The invention will not be utilized unless desire is fortified by purchasing power and the willingness to purchase the particular invention at a price that makes profitable production possible.

This type of intensive invention, which results in more complete satisfaction of existing wants, appears to have an effect upon the functioning economy similar to that of basic or extensive inventions, though not to the same degree. This type of invention is no radical innovation, but merely a logical development of an already existing good. Such improvements are more or less readily adopted, while the adoption of truly basic inventions takes a considerable length of time. Because of the length of time needed for the adoption of a really basic innovation the problems of assimilation are largely self-corrective. However, the rapid adjustments that are likely to follow the development of an

intensive invention of the type under consideration may tend to throw the economy away from equilibrium. This effect is produced by the immediate and insistent demand for additional labor, or more correctly, resources, with the use of which it is proposed to supply the new item to the consuming public.

All of the types of invention considered thus far—basic inventions introducing completely new utilities, basic inventions presenting substitute means of satisfying a desire already being satisfied but in an entirely different way, and developmental inventions that add to the want-satisfying power of already existing goods—appear to create no extensive problems of technological unemployment of labor or of the other factors of production. In fact, they all result in an expansion of the economy—that is, the effect is greater employment of the factors.[10]

Taking the situation as of any given time, and then assuming a series of inventions of the types considered, the availability of the factors places a limit upon the innovations that can be effected. Unless some means of economizing the productive factors is developed, the economy must eventually be limited in its expansibility. Here it is that the second subtype of intensive or developmental invention must be considered. Reference is made to those inventions which result in greater efficiency: those which make possible a greater output with the same input, or the same output with a reduced input. Of the examples cited above, the process of cracking petroleum to produce gasoline is an illustration of this type of invention, as is the development of the automatic textile loom. By use of the cracking process it is pos-

[10] Such inventions may necessitate a reapportionment of the factors, but the point that needs to be stressed here is that there is a net addition to the demand for the agents of production.

sible to get more than a barrel of gasoline from a barrel of crude oil, a great improvement over older methods. By introduction of the automatic loom it has been possible to effect considerable savings in the amount of labor required to produce a given amount of cloth.

Inventions of this type, unsupported by inventions that require greater and greater quantities of the factors, result in the disruption of the economy by throwing out of equilibrium the demand for and supply of the factors. Such inventions cause technological unemployment.

Until recent years the economy has absorbed with a minimum of suffering and unemployment the laborers that have been displaced by new machines.

The logical explanation for the absorption of technological progress is well known. It runs about as follows: (1) Intelligent business men introduce machinery if and when it reduces cost. (2) If competition is effective, cost reduction is followed by price reduction. (3) If price falls, more goods are bought, particularly in fields characterized by a relatively elastic demand. (4) If more goods are bought, displaced men will have to be recalled to produce them. (5) If more are produced, more raw materials will be needed. (6) If machines do the work of men, men will have to make the machines.[11]

The author of this explanation, which may have been correct for the conditions existing prior to World War I, subsequently concludes that the hypothesis from which it proceeds, effective competition, has not prevailed since the war. He then demonstrates how monopoly elements have caused the extensive unemployment of recent years.

Without any intention of detracting from the analysis presented in the article cited, it is here contended that there

[11] H. L. McCracken, "Monopolistic Competition and Business Fluctuations," *Southern Economic Journal*, Vol. V (October, 1938), p. 161.

is another element that warrants consideration. An important reason for the absorption of displaced laborers during the period prior to World War I was the parallel development of basic, "factor-using" inventions alongside the introduction of intensive, "factor-saving" inventions that increased the efficiency of the manufacturing process. Many great new industries providing employment for the displaced laborers were established. Since World War I a different situation has prevailed. Relatively few really new industries have developed, while there has been an extensive development of labor-saving devices, as compared with the prewar period. As a consequence, a relatively greater amount of labor has been displaced than could be reabsorbed in producing the greater quantities of goods that have been sold at the lower prices.

Because of the observable seriousness of unemployment it gets the attention of investigators and reformers, who propose various remedies, among them the bill introduced into the House of Representatives by Representative Hatton Sumners to stop the issuance of patents on labor-saving devices.[12] This is a negative means of attacking the problem. The positive, constructive method would be to encourage inventions of the "factor-using" types that have been considered above. Such a thought was expressed by Dr. Vannevar Bush, president of the Carnegie Institute, in his testimony before the Temporary National Economic Committee. He answered a query of Representative Sumners as follows:

> I feel, sir, that if our procedure for the introduction of new industries in this country, for the commercialization of new ideas and new things had been faster, had been ready, had been easily operated in the past decade, we would not have

[12] *Congressional Record*, Vol. LXXXII, Part 1, November 23, 1937, p. 323.

anywhere near the problem that we now face in that regard. The fact that new industries have not come ahead, that their way has been inhibited in a thousand directions, is one of the reasons that we are in difficulty at the present time. As industries grow old, there must be the advent of new industries to pick up the slack or we will have difficulty.[13]

Although not stated explicitly, the goal or ideal that Dr. Bush is proposing is that of a proper balance between the "factor-using" and "factor-displacing" inventions. "Factor-using" inventions are those basic developments that result in a net addition to productive activity, consumable goods, and employment. "Factor-displacing" inventions effect greater efficiency in the existing lines of production, thereby releasing labor and the other factors from employments in which they were previously engaged. Here is a delicate problem in equilibrium, to which there can be no easy solution because of the number of variables involved. The problem may be too intricate for mundane minds, but it can be stated that the orderly absorption of innovation, which is the basis for economic progress, depends on a balance being struck between these opposing forces. An important question in this respect is, "Can the patent system be so constituted as to help in attaining this balance?"

The National Bureau of Economic Research, in its study of prices, has set out information which is of interest in connection with the balance between these two types of inventions. Two tables based on the data collected by the Bureau are submitted (Tables I and II). From this statistical evidence it can be concluded that cost reductions effected prior

[13] *Investigation of Concentration of Economic Power.* Hearings before the Temporary National Economic Committee, 76th Congress, 1st Session, Government Printing Office (1939), part 3, pp. 895–96.

Hereafter, references to these hearings will be cited as follows: TNEC 3, pp. 895–96, the first figure in the citation referring to the part or volume of the series of hearings.

TABLE I

CHANGES IN PRODUCTIVITY AND THE FORTUNES OF MANUFACTURING PRODUCERS *

	Percentage		
	1899–1914	1914–1929	1929–1933
Change in output per worker, or per man hour worked	+29.6	+48.6	+19.0
Change in real returns, per worker employed, or per man hour worked, of			
Wage earners-mfg. plants	+4.8	+36.9	+15.5
Ownership and management-mfg. plants	+2.2	+61.5	+15.2
All agents of fabrication	+2.8	+51.3	+15.4

* Frederick C. Mills, *Prices in Recession and Recovery* (New York: National Bureau of Economic Research, 1936), p. 443.

to World War I were largely passed on to consumers in reduced prices, whereas after the war reduced costs were not passed on to consumers. Since the war some prices have fallen, but not as much as costs; other prices have actually increased while costs were falling.

It was concluded by Mills and his associates that before World War I competition was effective and prices were flexible and consequently responsive to changes in cost. These conditions have not prevailed since the war. The price structure has lost its flexibility. "Price regulation, monopolistic and semi-monopolistic control, trade agreements, changed distributive methods . . . extensive valorization efforts—these and other influences tended to render prices a less sensitive agency for the transmission of economic intelligence." [14] When equilibrium was being sought by flexible prices and capacity production, technological unemployment and business fluctuations resulting from the

[14] Frederick C. Mills, *Economic Tendencies in the United States* (New York: National Bureau of Economic Research, 1932), p. 557.

TABLE II

CHANGES IN MANUFACTURING PRODUCTIVITY AND THE FORTUNES OF CONSUMING GROUPS *

	Percentage		
	1899–1914	1914–1929	1929–1933
Change in real per unit cost of fabrication, in effort expended by producers	—22.8	—32.7	—16.0
Change in real per unit cost of fabrication to buyers of goods intended for human consumption:			
Farmers	—20.9	+15.2	+50.1
Wage earners, general	—23.4	—27.1	—13.8
Salaried workers, manufacturing	—11.8	—17.6	+12.5
Primary producers, non-agricultural	—0.1	+20.9	—1.5

* Mills, *Prices in Recession and Recovery*, p. 447.

dynamics of change were relatively mild, whereas the post-war efforts to maintain prices and secure equilibrium by means of flexing production have resulted in technological unemployment and business fluctuations of increasing severity.[15]

This is a well-reasoned analysis of undoubted validity, but in the light of the previous discussion of the various types of inventions and their effects upon the demand for the factors of production, it appears that there is another element that should be considered. This element is the necessity of maintaining a proper balance between those inventions that result in a net addition to productive activity, consumable goods and employment, which have been referred to as "factor-using," and the "factor-displacing" inventions that merely increase the efficiency of already established industries, enabling them to maintain the same rate of output while dispensing with part of their labor force and using smaller amounts of the other factors.

[15] See McCracken, *op. cit.*, p. 162.

This brings into focus an element that previously may have been neglected by students of technological unemployment. It has been mentioned above that the continued introduction of new "factor-using" inventions would be impossible unless "factor-saving" inventions were developed simultaneously. Otherwise there would be a shortage of the means of production. This problem was very real prior to World War I. Such important new developments as the railroad, the steamboat, electric power, incandescent lighting, the telegraph, and the telephone were presented to the world. These inventions created an immense net addition to the already strained demand for the means of production. Some idea of the pressure of the demand for labor can be gained from the fact that during the period 1901–1913 the number of wage earners employed in manufacturing increased at an average annual rate of 2.7 per cent, while the average annual rate of population growth was but 2.0 per cent.[16] Unemployment could hardly be a serious problem under such circumstances.

But during the period 1922–1929 the reverse condition prevailed. The average annual rate of population increase was 1.4 per cent, while the number of wage earners in manufacturing plants increased at an annual rate of but 1.0 per cent.[17] Is it not possible that an important element in the explanation of this changed situation can be found in the disparity between "factor-using" and "factor-displacing" inventions? In the years since the war great emphasis has been put upon efficiency, upon labor-saving devices, upon standardization and large-scale production, upon cost-reducing innovations. During this period there has come forward but a single new industry to absorb the factors released by the

[16] Mills, *Economic Tendencies*, p. 417.
[17] *Ibid.*

intensive developments designed to increase efficiency.[18]

Economists have long held the idea that the capitalistic, roundabout method is superior to direct production, resulting in an increased output from a proportionately smaller input.[19] It has been held that as more capital is introduced into the productive process the end product is increased, and sufficiently increased to more than reimburse the entrepreneur for the added cost incurred. Every time an additional "order" of goods [20] could be interposed between the raw material and the finished product, a net gain could be anticipated. The evidence of history substantiates this. In recent years, however, there has been observable a change which suggests that under certain circumstances the very reverse effect may prevail.

Efficiency engineers and inventors achieved remarkable

[18] Reference is made to television, which appears to be the only basic invention made since World War I. It has not provided a haven for displaced labor because developments in the techniques and equipment for television have been too rapid to make standardization feasible. Television has not yet passed out of the developmental stage. It still remains to be exploited.

It is true that there have been some notable industrial developments since World War I. The automobile industry, mechanical refrigeration, and air transport come immediately to mind. But their development started before the war. Since the war they have made immense strides because of efficiency-producing inventions that have enabled cost reductions. Relatively, since the war there have not been enough basic "factor-using" inventions to employ the available factors. (See Charles F. Kettering's testimony in TNEC 2, pp. 351–52.) Improved efficiency and population growth have outstripped basic developments that effect a net addition to employment.

[19] Eugen V. Böhm-Bawerk, *The Positive Theory of Capital*, trans. William Smart (New York: G. E. Stechert and Co., 1930), Bk. V, Ch. IV.

[20] Carl Menger, in his *Grundsatze der Volksevirtschaftslehre* (1871), divided goods into different classes or "orders," according to their nearness to the consumer. For discussion see Alexander Gray, *The Development of Economic Doctrine* (London: Longmans, Green and Co., 1931), pp. 345 ff., and William A. Scott, *The Development of Economics* (New York: The Century Co., 1933), pp. 331–32.

results after World War I. They introduced much more efficient combinations of the factors than had previously been utilized. This is shown by the figures given in Table II. During the fifteen years before World War I the real costs of production were lowered by 22.8 per cent, while in the next fifteen year period, 1914–1929, they were further reduced by 32.7 per cent. Then, in the short period of four years from 1929 to 1932, they were reduced by an additional 16 per cent. The cumulative effect of the developments during that span of years was that the real costs of production in 1932 were but 56.5 per cent of what they were in 1941, and but 43.9 per cent of what they were in 1899. Such a reduction in real costs can only mean that smaller amounts of the factors were being utilized to accomplish a given result: that fewer "orders" of goods were interposed between raw material and finished product. Because new industries did not come forward to absorb the displaced factors, the economy was thrown out of balance.

Two kinds of balance are required, according to Sir Josiah Stamp. One is that noted above, between inventions which create new kinds of economic satisfactions (direct innovations), and those which make easier the production of existing economic goods (derivative innovations). Secondly, obsolescence and depreciation must be kept in balance, or economic progress may be upset in the face of rapid innovation.

> The problem of balance, in the direct and the derivative, is not, however, so simple in practice, for the sum total of the effect of derivative innovations (creating technological unemployment) ought to be balanced by the sum total of direct innovations or increased demand for other products (new and expanded employment). But many direct innovations are not additive; they are substitutional, and destroy the need for old commodities. . . .

The second kind of balance which is vital to economic progress and may be ruined by over-rapid innovation is that between obsolescence and depreciation. Nearly all scientific advance for economic progress has to be embodied in capital forms, to be effective, more and more elaborate, large and costly. . . . If the period of physical life and fashionable life can be made to correspond, there is greatest economy and security of capital. But if the expensive embodiment of the latest science can be outmoded and superseded long before it is worn out, there is waste of capital, loss of interest, and resultant insecurity of business and investment.[21]

It is conceivable that innovations might be forthcoming at such a rapid rate that no sooner would one change be adopted than it would be superseded by a subsequent development. Such rapid developments might threaten orderly assimilation and, on account of the great uncertainties that would attend new investments in industry, result in some degree of stagnation. A possible means of counteracting this effect might be found in making the smallest possible capital investment in the new devices, with the idea of wearing them out before they became obsolete. It certainly would be the height of folly to make permanent commitments in the face of further anticipated innovations.

The problem of obsolescence, however, may not be so acute. This was the thought expressed before the House Committee on Patents in 1938. At that time William B. Barnes, an automotive engineer, stated that for "any industry that is not dead, the factor of tool obsolescence and so on is relatively small potatoes. . . ." [22] His reasoning was that if the industry is characterized by "live wires"—by efficient,

[21] Stamp, "Must Science Ruin Economic Progress?" p. 430.

[22] *Compulsory Licensing of Patents.* Hearings before the Subcommittee on Compulsory Licensing, Committee on Patents, House of Representatives, 75th Congress, 3d Session, on H. R. 9259, H. R. 9815, and H. R. 1666, Government Printing Office (1938), p. 192. Hereafter this document will be referred to as H. R. 9259.

progressive management—it is perfectly willing to write off the books a sizable amount of obsolete tools and equipment for the sake of presenting a superior article to the public. By reason of the economies thereby effected in production, he contended that it would be possible to liquidate any loss in the write-off within a few months' time.

The differences between Sir Josiah Stamp and Mr. Barnes on this point are not fundamental. Rather, they turn on the differing value judgments of the two men, which are undoubtedly arrived at in the light of their own particular experiences. The English gentleman, steeped in the traditional English conservatism, sees obsolescence as a grave source of difficulty under modern conditions of rapid technical innovations. Mr. Barnes, on the other hand, imbued with the typically American enthusiasm for change (if not progress), finds the problem of obsolescence one that requires no more than routine treatment. He believes that the costs of adopting technical improvements are self-liquidating. It is quite likely that both of the viewpoints here presented have been overdrawn. Somewhere in the middle ground there is a rational approach to the problem.

To sum up the discussion of the effect of development or intensive inventions that are "factor-saving," there are three points to be stated. "Factor-saving" inventions are necessary in order to relieve the pressure built up by the "factor-using" inventions; however, if there is not a sufficient development of "factor-using" inventions, serious problems of disequilibrium and unemployment result. Furthermore, if the new developments come forward at too rapid a pace, conditions of unbalance between obsolescence and depreciation will prevail.

Conditions favorable to invention. Attention is now directed to the sort of culture medium which is conducive to

invention. It is an observable fact that the peoples of some countries make relatively more inventions than those of other countries. Can this be explained by differences in the people themselves, or can part of it, at least, be explained by the different culture mediums in which the people live? There is reason to believe that some culture mediums are especially conducive to inventive activity.

One condition that favors invention was noted by Adam Smith to be the division of labor. The minute and technical division of labor, which results in a man's employment being of a highly specialized but relatively simple type, has resulted in the contrivance of mechanical means of accomplishing the simplified tasks.

I shall only observe, therefore, that the invention of all those machines by which labour is so much facilitated and abridged, seems to have been originally owing to the division of labour. Men are much more likely to discover easier and readier methods of attaining any object, when the whole attention of their minds is directed towards that single object, than when it is dissipated among a great variety of things. But in consequence of the division of labour, the whole of every man's attention comes naturally to be directed towards some one very simple object. It is naturally to be expected, therefore, that some one or other of those who are employed in each particular branch of labour should soon find out easier and readier methods of performing their own particular work, wherever the nature of it admits of such improvement. A great part of the machines made use of in those manufactures in which labour is most subdivided, were originally the inventions of common workmen, who, being each of them employed in some very simple operation, naturally turned their thoughts towards finding out easier and readier methods of performing it. . . . In the first fire-engines, a boy was constantly employed to open and shut alternately the communication between the boiler and the cylinder, according as the piston either ascended or descended. One of those boys, who loved to play with his

companions, observed that, by tying a string from the handle of the valve which opened this communication to another part of the machine, the valve would open and shut without his assistance, and leave him at liberty to divert himself with his playfellows. One of the greatest improvements that has been made upon this machine, since it was first invented, was in this manner the discovery of a boy who wanted to save his own labour.[23]

Countries such as England, Germany, and the United States, where the industrial processes are characterized by a high degree of division of labor, are countries in which inventive activity has reached, and been maintained at, a high level. Countries such as France, Italy, and especially China, where productive organizations have been strikingly dissimilar, have not been known for their inventive activity.

Another factor influencing invention is the state of the arts and sciences—the amount of accumulated knowledge available for utilization by inventors.[24] It is held by some that invention cannot justly be attributed to individuals, because any one person contributes so little as compared to what has gone before which is properly conceived as being a social heritage.

Technological knowledge is of the nature of a common stock, held and carried forward collectively by the community, which is in this relation to be conceived as a going concern. The state of the industrial arts is a fact of group life, not of individual or private initiative or innovation. It is an affair of the collectivity, not a creative achievement of individuals working self-sufficiently in severalty or in isolation. In the main, the state of the industrial arts is always a heritage out of the past; it is always in process of change, perhaps, but the sub-

[23] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776), Bk. I, Ch. I.

[24] See Ralph C. Epstein, "Industrial Invention: Heroic or Systematic?" *Quarterly Journal of Economics*, Vol. XL (February, 1926), pp. 232–72.

stantial body of it is knowledge that has come down from earlier generations. New elements of insight and proficiency are continually being added and worked into this common stock by the experience and initiative of the current generation, but such novel elements are always and everywhere slight and inconsequential in comparison with the body of technology that has been carried over from the past.[25]

Regardless of the question of giving credit to individuals for "their" inventions,[26] it will be readily acknowledged that the amount of invention can increase more than in proportion to the amount of available knowledge.[27] There is the possibility of linking each new bit of knowledge with all of that which has preceded it. This results in an increasing rate of probability of additional invention. The conclusion is that the possibility of invention is enhanced in societies that have developed and nurtured the arts and sciences.

Another condition favoring inventive activity is a recognized sense of incompleteness—with a feeling that improvement is possible—arising out of dissatisfaction with the apparent limitations of life, and the apparent rules that hamper comfort, success, or enjoyment. Here the argument might be phrased in terms of necessity—that "necessity is the mother of invention"—although in all likelihood "necessity" is altogether too strong a word to convey the correct impression. "Desire" is probably the more accurately descriptive word. Recognition of wants—of a desire yet to be satisfied—is a condition conducive to inventive activity. Natives of the tropical areas of the world have wants of such a low

[25] Thorstein Veblen, *The Instinct of Workmanship* (New York: Macmillan, 1914), p. 103.

[26] See *Pooling of Patents*. Hearings before the Committee on Patents, House of Representatives, 74th Congress, on H. R. 4523, Government Printing Office (1936), pp. 935 and 939. Hereafter this document will be referred to as H. R. 4523.

[27] TNEC 3, p. 1090. Testimony of George Baekeland.

Mr. Kettering's idea is one that shrouds the inventor in an aura of mysticism, doing things without any more explainable motive than the mere wanting to do it. The above quotation was a spontaneous reply to oral questioning when Mr. Kettering was in the witness chair before the TNEC, but it is probably typical of the unconsidered thoughts of large numbers of people. In contrast, consider the conclusion of Joseph Rossman, Patent Examiner, United States Patent Office, and editor of the *Journal of the Patent Office Society*, after completing an extensive study of inventors and the motives of inventors.

> It is the function of the inventor to teach us how to apply for practical purposes the knowledge which science gives us. Very few basic inventions can be attributed to pure science. . . .
>
> Scientists have unquestionably performed miracles, and they have extended our knowledge into unknown realms. However, knowledge alone, no matter how penetrating and astounding it may be, never gives rise to new inventions or industries. It is usually left to the inventor to utilize the facts and principles of science, and to apply them for practical purposes.[2]

The idea here expressed is that it is the function of the inventor to apply known principles of knowledge to given ends, such ends effecting the practical utilization of any knowledge that is available. In some cases it may be that the inventor actually moves ahead of the scientists, utilizing principles which are not yet explained by them,[3] but this need not alter the concept of the inventor.

Further understanding of the inventor may be obtained by noting the characteristics of inventors. Rossman circularized 710 inventors, 78 directors of research, and 176 patent attorneys. The inventors were asked, "What are the characteristics of a successful inventor?" The research directors

[2] Rossman, *The Psychology of the Inventor*, p. 19.
[3] *Ibid.*

were asked, "What are the mental characteristics of research workers and inventors?" The patent attorneys were asked, "What are the mental characteristics of inventors?" The results of these three surveys are combined in Table III.

TABLE III

CHARACTERISTICS OF THE INVENTOR *

Characteristics	Frequency of characteristics mentioned by		
	710 Inventors	78 Directors of Research	176 Patent Attorneys
Perseverance	503	41	20
Imagination	207	35	34
Knowledge and Memory	183	—	—
Business Ability	162	—	—
Originality	151	37	64
Common Sense	134	—	—
Analytic Ability	113	48	44
Self-confidence	96	—	—
Keen Observation	61	12	18
Mechanical Ability	41	—	6
Training and Education	—	20	—
Reasoning and Intelligence	—	20	—
Competence	—	16	—
Lack of Business Ability	—	—	26
Suspicion	—	—	12
Optimism	—	—	12

* Rossman, *The Psychology of the Inventor*, pp. 39–40.

Perseverance, originality, and imagination are found among the five highest frequency traits mentioned by all three of the circularized groups. This seems significant, for the three groups were looking at the same problem from three different angles.

Motives of inventors. The human agency through which invention is forthcoming is the inventor. Any control over invention must be exerted through the inventor. If a society should desire to affect the stream of invention—to augment it, to decrease it, or to direct it specifically along certain lines conceived to be especially desirable—it must shape its program in the light of the forces that motivate inventors. Assuming the desirability of affecting the stream of invention as a matter of social policy, the steps that should be taken to make the policy effective might be many and varied. Such programs are, however, beyond the limits of the present discussion; but consideration will be given to the motives of inventors, which are: the desire for economic reward; the desire for self-expression; the desire for the reputation that comes with achievement; the desire to improve existing devices and methods; altruism; and laziness.

The study of 710 inventors made by Rossman, referred to above, yielded first-hand information about the incentives that have influenced inventors in their undertakings. Questionnaires were sent to the inventors, including a number who have hundreds of patented inventions to their credit, the average number for the entire 710 being 39.3. The results are tabulated in Table IV.

It appears that some of these motives or incentives are not mutually exclusive, so they may be combined and treated together. This is especially true of *financial gain* and *part of work*. If the frequencies of these two motives be added together, the sum 226 makes the desire for economic reward the motive of greatest frequency.

There is adequate reason for considering these two motives as one. Those men employed by research departments maintained by large business units are employed to invent. They originally seek employment for economic reasons—to

TABLE IV

FREQUENCY OF MOTIVES OR INCENTIVES MENTIONED BY 710 INVENTORS *

Love of Inventing	193
Desire to Improve	189
Financial Gain	167
Necessity or Need	118
Desire to Achieve	73
Part of Work	59
Prestige	27
Altruistic Reasons	22
Laziness	6
No answers	33

* Rossman, *The Psychology of the Inventor*, p. 152.

assure themselves an income—but once employed invention becomes a part of their duties toward their employer. The primary cause of their creative activities is economic, though the proximate cause is that they are merely following the instructions of their employer.

Further reason for considering the economic motive of paramount importance is found in additional information obtained from Rossman's 710 inventors. Of the 694 answering this particular group of questions, 38.2 per cent earned their livelihood by inventing and 22.7 per cent partially earned their livelihood by inventing, while only 39.1 per cent did not earn their livelihood in that way.[4] Thus, a total of 60.9 per cent, or 423 out of the 694 inventors, relied to some extent upon their inventions to furnish a part of their livelihood. Taussig also concluded that monetary return was a motivating influence deserving emphasis and cited illustrations to prove his point.[5]

[4] *Ibid.*, p. 157.
[5] Taussig, *op. cit.*, Ch. I.

The desire for economic reward motivates inventors through the prospect of income, or profits, from the marketing of inventions. There will be an influx of inventive talent to a particular field if it is seen that developments in that field hold out the prospect of pecuniary returns. In this respect the inventor must be considered as a combined entrepreneur and laborer. As an entrepreneur he seeks out that field in which there is a good prospect for profit; as a laborer he applies his abilities to that field. It is possible to distinguish between these two points of view and to note that one actually motivates inventive activity, the other serving to direct it into specific applications.

Viewing the inventor first as a highly specialized laborer, it is recognized that he will put forth his efforts in return for his "wage." It is probably correct to assume that an inventor, well grounded in the basic knowledge of scientific and technical principles, can successfully turn his talents to a number of different fields, and therein earn his keep. Edison achieved distinction and financial success in a number of seemingly unrelated fields. Werner Siemens demonstrated this versatility by beginning with inventions relating to the telegraph and proceeding to the metallurgy of iron and copper, devoting his last years to the field of pure science. Another inventor with several unrelated but financially successful inventions to his credit is Henry J. Gaisman, the inventor of the autographic camera and autographic film, and the "Probak" razor blade, which last was of such merit as to revolutionize the price structure in the market for safety razor blades.[6] The versatility of inventive ability contributes to the success of its employment for a wage in the same way that other labor powers are employed.

[6] H. R. 4523, pp. 690 ff., especially pp. 692 and 698.

Evidence of the inventor's satisfactory reaction to pecuniary return is found in the efforts of those who have been referred to as the "captive" inventors of large industrial companies, employing that adjective in a way analogous to the way it is used to designate the coal mines owned by the steel companies.[7] These captive inventors are employed at a salary, usually fixed in advance, and turn out their inventions in a fairly routine way. Thus, General Motors hires its inventing done in much the same way that it hires the painting done in its body shops. Other illustrations could be cited to reinforce the conclusion that inventors are motivated to "invent" by the prospect of a monetary return.[8]

There is, implicit in this conclusion, a likening of inventors to other types of highly skilled labor. There was a time when the shoemaker, for example, was a combined laborer, capitalist, and entrepreneur, performing the functions pertaining to each. But with the greater complexity of the business world and the necessity for greater amounts of capital, these functions were split off, one from the other, and carried on by separate individuals or groups. Whereas the shoemaker originally judged the market and determined what to produce and then produced it, he subsequently allowed the entrepreneur to decide what to produce and followed the entrepreneur's, his employer's, directions. At the same time he used the employer's capital equipment rather than providing his own.

The transition of the shoemaker from an independent entrepreneur-capitalist-laborer to an employed laborer finds

[7] This is a term used by Willis B. Rice, lecturer on patent law at New York University. See H. R. 4523, p. 565.

[8] It is recognized that the economic reward may not be the sole motivating force in the above-cited illustrative cases. It is, however, common to all of them.

a parallel in the transition of the inventor from an entrepreneur-capitalist-laborer to an employed laborer. The process has not been as complete in the case of the inventor, for there are still large numbers of independent inventors. But the rapid growth in the number of research laboratories and the number of captive inventors employed therein, following someone else's direction and using equipment they do not themselves own, demonstrates the separability of the three functions. The case of the captive inventor tends to show that financial return in the form of a wage or salary will motivate inventive activity, and that such activity can be directed along the lines desired by the employer.

The price and profit system of our pecuniary economy is by far the most important force exerting directive influence upon inventive ability. It may act upon the inventor either directly or indirectly. Independent inventors are influenced directly, for they must rely upon their own entrepreneurial judgment to place them in a paying field of development at the proper time. Captive inventors are relieved of this responsibility and accept the judgment and direction of their employers, so the directive influence of the price structure affects them only indirectly.

Even if there be some doubt as to the motivating power of economic reward on the quantity and quality of invention and inventive activity, there can be no doubt that by far the greater part of inventive effort is subject to the important directive influence of price conditions.

The price conditions which induce inventions in particular fields are those which offer a special return to inventors in those fields. The inventions may be induced either by the possibility of quite exceptional profits to those who can cut costs still further during times of flourishing trade, when an industry is already profitable, or by the imminence of certain loss to entre-

preneurs who have fixed investments in industries which are depressed, and whose only hope is an innovation which will reduce expenses below receipts.[9]

No effort is being made here to establish the desire for economic reward as the sole motivating force acting upon inventors. In some cases it undoubtedly has no influence whatsoever; in others it is absolute; while in a great many cases it is one of several motives to which the inventor reacts. But where the economic motive does exert an appreciable influence, it is proper to refer to the results as induced inventions. By this we mean that the dynamics of the modern economy, operating through the price mechanism, induce certain activities, the results being known as induced inventions.

Certain conclusions can be reached concerning induced inventions. Price changes provide a double stimulus to invention, particularly if it appears likely that the new prices will assume some degree of permanence. This conclusion follows because of the cost difficulties created in certain fields, alongside opportunities for profits in other fields. Inventive activity will be called upon in order to cut down possible losses and to take advantage of possible profits. At such times an increase of invention and a decline in other activity may be expected.[10] This result will follow from the shift of ability and activity to those fields of greatest promise, since invention is considered in the same order as teaching and other professional activities. A further conclusion is justifiable. Large price changes will result in a greater stimulus to invention than will small changes, for the possible profits and losses will be that much greater. Stated differently, the supply curve for inventive activity is not perfectly

[9] Plant, *op. cit.*, p. 36.
[10] *Ibid.*, p. 40.

inelastic. Finally, falling prices probably stimulate inventions that reduce costs, whereas rising prices are more conducive to basic inventions upon which new industries are founded.

It can be said, then, that the possibility of gratifying the desire for economic reward calls forth inventive activity, the greater amount of such activity being devoted to those endeavors that hold promise of yielding the greatest returns. There may be some question, however, that this motive exerts any influence upon men of the pure sciences and the professions. For many years discussion has raged concerning the gainful exploitation of inventions made by men in the professions. It seems likely that much of the disdain for such pecuniary rewards stems from the ethics of the profession rather than from the nature of the men themselves. Increasingly large numbers of men in the professions—engineering, chemistry, and medicine—are seeking profitable development of their inventions, but it is difficult to determine whether there is a definable trend in this direction.

Another angle of the situation is that men in the professions and sciences prefer to devote their energies to their investigations rather than to the chrematistic exploitation of what they have developed. It is related of Louis Agassiz that on a certain occasion a friend suggested a legitimate opportunity to avail himself of a tempting financial return. "I have no time to make money," was the retort of the naturalist.[11] Such a statement expresses the allegedly typical attitude of the research worker toward the profit motive. There is in many a scientist's attitude a gesture of repugnance toward money-making as a practice inconsistent with intellectual integrity. Such minds are represented as considering time precious, and money secondary. To them, the adventure of

[11] G. W. Gray, "Science and Profits," *Harper's*, Vol. CLXXII (April, 1936), p. 539.

discovery is more pleasurable than the pursuit of its material rewards.

Undoubtedly, many inventions are a by-product of mental activity. They are a means of self-expression, just as the painting is an expression of the artist. Man likes to engage in creative activity—to have something to show for his activity. He is especially gratified if the results are new—not merely a copy of what someone else has previously done. It will be recalled that Rossman's tabulation of the returns from his questionnaires led him to conclude that the love of inventing was the most important motivating force affecting inventors. Inventing for the sheer love of inventing practically coincides with gratification of the desire for self-expression. It would be difficult to determine the importance of the inventions that result from this motivation. There is a prima facie case, however, for expecting inventions that are the result of a desire for self-expression to be of minor importance—many of them being of the "gadget" type—because the stakes that come with success are so indeterminate, and the requirements for efficiency are so low.

The desire for reputation and prestige is a likely motive of inventors in some fields. This could well be an important factor in explaining the activities of men in the professions. The surgeon who develops a new instrument for bronchial operations is hailed throughout the profession, and his opinions and encouragement are much sought after. This motive may be similarly effective upon men throughout the sciences. Rossman's study found a number of inventors who had been motivated by prestige, and also a number who had invented in order to satisfy a desire to achieve. If it was a reputation that they had wished to achieve, the frequency of these combined motives stands up pretty high in the ranks.

Men may be moved by a desire to improve upon existing

devices or methods. In Rossman's study this motive was ranked as second in importance. The large number of improvement patents that are granted, as compared with basic patents, would confirm the importance of this as a motivating force. It is difficult to distinguish a definite desire to improve upon something, however, from the desire to effect an improvement in order to achieve some means of increasing the financial returns from it.

As for altruism and laziness they are probably motives in some cases, but it is doubtful that many inventions of great importance could be explained in terms of either of them alone. It is said that Lord Byron invented a wheel chair for invalids and refused to accept any patent protection for his invention in order that it might be widely adopted and be of benefit to those needing some such device. There are no doubt other similar cases of altruism, but they have not been widely publicized. There is likely some bit of altruistic endeavor in most inventions, though it is seldom the dominant motive. Similarly with laziness—probably many inventions are brought forth to save effort. It might be argued that the illustration of the boy improving the steam engine, as related by Adam Smith, is an illustration of laziness motivating invention. The desire to economize human labor has probably been a consideration in undertaking many inventions, but it is unlikely that it has been the sole motive in a very large number of cases.

It is impossible to attribute every invention to a single motive. For many inventions, there are a number of forces that come to bear upon the inventor, but in most cases it would seem that the hope of some sort of economic reward is present.

Inventors, after all, are practical men who express their ideas in physical form at the expense of time and money. It is, there-

fore, only natural that they should not be content with honor or glory alone as a reward. Even though the greatest and immediate reward of the inventor is the sheer joy of the work, inventing is a business undertaken with a hope of profit. The experience of a need or necessity usually initiates the inventive process; in order to bring it to a successful completion the dynamic spur of profit, coupled with joy derived from creating or improving, is essential.[12]

Patent system as a motive. In considering the patent system as a motive for invention, it is necessary to recognize that when an inventor obtains a patent he gets a monopoly grant from the government giving him the right to dictate the conditions under which his invention may be used. The question for consideration here, then, is, "How effective a motive is the prospect of being able to monopolize whatever is invented?" In other words, will men work to secure a monopoly such as a patent bestows upon an inventor?

It is possible to cite considerable authority to substantiate an affirmative answer to such a question. In a section on monopolies, to which he was opposed, John Stuart Mill considered the patent monopoly as one quite justifiable exception, and one which was in the public interest. Unless the patent monopoly were allowed, he feared that the ". . . expenses and labours [of inventors] would be undergone by nobody except very opulent and very public-spirited persons . . ." [13] and that the public would be the loser. J. B. Clark held a similar opinion and considered patents as a monopoly that could be justified on the basis of the public interest.

If an invention became public property the moment that it was made, there would be small profit accruing to anyone from

[12] Rossman, *The Psychology of the Inventor*, p. 159.

[13] John Stuart Mill, *Principles of Political Economy* (1848), Bk. V, Ch. X, sec. 4.

the use of it and smaller ones from making it. Why should one *entrepreneur* incur the cost and risk of experimenting with a new machine if another can look on, ascertain whether the device works well or not, and duplicate it if it is successful? Under such conditions the man who watches others, avoids their losses, and shares their gains is the one who makes money; and the system that gave a man no control over the use of his inventions would result in a rivalry in waiting for others rather than an effort to distance others in originating improvements.[14]

Friedrich List, well acquainted with the economies of both the new and the old world of his own day, was a strong believer in patents. He wrote that "The granting of patent privileges offers a prize to inventive minds," and "The hope of obtaining the prize arouses the mental powers, and gives them a direction towards industrial improvements. It brings honor to the inventive mind in society. . . ." [15]

The present Commissioner of Patents, Conway P. Coe, believes that the influence of patents is "creative," that "they operate to multiply and expand acquisitions by the public." [16] Dr. William D. Coolidge, director of the General Electric Company research laboratory, has a similar belief about patents. "I think it often happens that the original invention without improvements would not come into general use but that the publication through the patent of the basic patent does stimulate others to make detailed inventions. . . ." [17] Here Dr. Coolidge sees the disclosure of new knowledge and methods of applying it as the proximate cause of the increased inventive activity, rather than the

[14] J. B. Clark, *Essentials of Economic Theory* (New York: Macmillan, 1907), p. 360.

[15] Friedrich List, *The National System of Political Economy*, trans. Sampson S. Lloyd (London: Longmans, Green and Co., 1928), p. 246.

[16] TNEC 3, p. 841.

[17] *Ibid.*, p. 922.

monopoly grant as being the incentive. His statement continues, however, to the effect that two or more men who have complemented one another's inventions may thereby be able to realize a return from something that would not otherwise have existed.

Oftentimes, when competitors come out with patented improvements on their products which cannot be copied, invention is stimulated, for it means that a producer has to devise an even better invention.[18] This type of situation leads to the invention of substitutes; but presumably each new device is an improvement, and so there is a net social gain. It also results in a number of competing monopolies, for each alternative is monopolized, but all the products are in competition one with another. There is monopolistic competition.[19] Such was the content of the testimony of Ralph E. Flanders, president of the machine-tool manufacturers, Jones and Lamson.[20] Another representative of the machine-tool industry has given similar testimony; he pointed out that because of the necessity of developing substitute products, the public has a greater variety of goods from which to choose.[21]

There are grounds, then, for concluding that the patent system motivates inventive activity, although there are some who would not concur, for they do not recognize the desire for economic reward as a force motivating invention. There is much stronger reason to believe that the patent system directs inventions along certain channels. "By offering the prospect of reward for certain types of inventions . . . [the patent laws] do not, indeed, appreciably stimulate in-

[18] H. R. 9259, p. 392. Testimony of Edward R. Kast.
[19] See *infra*, Chapter VII.
[20] TNEC 3, pp. 928–29.
[21] H. R. 9259, p. 42. Testimony of Harvey W. Hawgood.

ventive activity, which is, for the most part, spontaneous, but they do direct it into channels of general usefulness." [22]

This position, taken by Pigou, warrants further consideration. It assumes a completely inelastic supply curve for inventive activity, or an approach to that. There is, however, some considerable degree of elasticity for this supply curve. There are a number of alternative occupations to which inventors may be attracted, such as university teaching, researches into the pure sciences, and engineering positions in industry itself. If inventing should offer sufficient prospects, they would shift into it, only to drop out again if the prospects were found unwarranted.

There is still the problem of net social product to be considered. What would be the effect upon the net social product if those individuals who have inventive ability, but are employed at some other task, should shift into inventing as a result of the prospective returns obtainable? Would there be any change? Possibly not, at least until the effects of the new inventions become more or less generally diffused.

As Professor Taussig said, the utilitarians assumed that the patent system was responsible for the greater part of inventing activity. The question which they, one and all, failed to ask themselves, however, is what these people would otherwise be doing if the patent system were not diverting their attention by the offer of the monopolistic profits to the task of inventing. By what system of economic calculus were they enabled to conclude so definitely that the gain of any inventions that they might make would not be offset by the loss of other output? By no stretch of the imagination can the inventing class be assumed otherwise unemployable. Other product which is foregone when scarce factors are diverted in this way completely escaped their attention.[23]

[22] A. C. Pigou, *The Economics of Welfare*, 2d ed. (London: Macmillan, 1924), p. 163.

[23] Plant, *op. cit.*, p. 40.

It might be noted that the inventor class is probably not otherwise unemployable, but there is no reason to believe that all who have inventive ability are equally productive when employed outside of inventing. If this be true, the net social product would be augmented by any change from their existing employment into inventing, the employment in which they experience their greatest productivity. In addition, it is possible that greater incentives call forth greater efforts, and greater results. If so, the patent system may incite otherwise lethargic inventive abilities to greater activity. And, finally, it is possible that the existence of adequate rewards will keep active inventive ability which would otherwise fail to function on account of the retirement of its possessor.

There is, of course, a great deal of invention that goes on outside of the patent system. Even in the absence of patents, a sufficient price incentive might exist in the open market to direct inventive activity into the same fields. An illustration of this fact is to be found in the designing of textiles, where the rate of invention, introduction, and obsolescence exceeds the rate at which patents can be obtained, and so patent protection is usually foregone.[24] Another group of inventions that would exist outside of the patent system is that which arises spontaneously, whether by accident or as a manifestation of an "instinct of contrivance" in persons whose inventing is uninfluenced by any economic stimulus.

Most inventors, to sum up the discussion, are influenced in their activities by the prospect for economic reward. Open market prices, by themselves, may offer sufficient prospect

[24] *Design Protection.* Hearings before the Committee on Patents, House of Representatives, 72d Congress, 1st Session, Government Printing Office (1932). Also *Design Protection and other Patent Bills.* Hearings before the Committee on Patents, House of Representatives, 74th Congress, 1st Session, Government Printing Office (1935).

of return to stimulate invention. The patent system is founded on the belief that economic reward motivates invention. The patent monopoly proposes to assure or augment the pecuniary return obtainable from an invention. It thereby calls forth additional inventive activity (the amount depending upon the elasticity of supply of this very specialized type of labor), as well as serving to direct activity into those fields where it is especially desired. Finally, the patent system may influence the ability and willingness of entrepreneurs to make use of new inventions, guaranteeing to them a monopolist's profit for such a period of time as to attract the speculative capital necessary for exploitation.

CHAPTER III

FUNDAMENTALS OF THE PATENT SYSTEM

PATENT systems, as established in the various countries of the world, bear witness to a strong and widespread desire to foster innovation and invention. Whether or not patent laws have succeeded in stimulating invention may be open to question, but any careful study of these laws shows clearly the prevalence of a belief that invention will be stimulated by paying men to invent.

A patent grant of monopoly is the method quite uniformly employed in capitalistic, *laisser-faire* economies as the means of providing inventors with an incentive to develop and disclose new ideas. This implies that the patent systems are postulated on the belief that the desire for economic or pecuniary reward motivates inventors, since the patent monopoly is designed to assure or augment the economic returns arising from an invention. If it could be proved that the desire for economic reward is not the dominant motive, there would be little justification for such a monopoly grant. If it could be shown that most of the important inventions were the result of an "instinct for contrivance" or the "instinct of workmanship"—that invention would be forthcoming without any added pecuniary incentive—then the patent system would be without a sufficient *raison d'être*. Or, if it could be shown that free competition, freedom of enterprise, and competitive prices provide a sufficient incentive

to the inventor, again the patent grant of monopoly could not be reasonably defended.

The problem has two phases, however, only one of which is considered above. After an invention is made, it is necessary to introduce it to the public. The patent monopoly helps during this second phase. The patent grant of monopoly makes possible the uninterrupted development of the new idea and its introduction to the public by assuring the promoters a period during which they are freed from the harassment of competitors. It assures the owners of capital that there will be a period for exploitation of the market at a monopoly price. It removes some of the risk usually incident to new undertakings and induces lenders to advance speculative capital to finance the venture.[1]

We must bear in mind that the mere love of inventing would in itself often be insufficient to bring an invention to fruition. Before any invention is perfected and marketed much money must be spent in developing and perfecting the original mental conception. The inventor either must spend his own money or interest business men in his invention. In either case, unless there is a prospect of gain, the chances are that no money would be spent in developing the invention to a practical basis.[2]

Originally the patent system was conceived as a means of encouraging invention and the practical exploitation of new things. There may be doubts in the minds of some that it encourages invention, but there is no question that it does encourage the practical exploitation of new ideas.

It has been noted that the capitalistic nations endeavor to promote invention and obtain the exploitation of new ideas by the grant of a legal monopoly. Totalitarian nations find this method inexpedient; they give rewards to inventors.

[1] TNEC 3, p. 1049. Testimony of Clarence C. Carlton.

[2] Joseph Rossman, "The Motives of Inventors," *Quarterly Journal of Economics*, Vol. XLV (May, 1931), p. 524.

Such rewards *may* motivate inventive activity, but they are subject to serious criticism. For the state to make a grant to the inventor, whether it be monetary or otherwise, a value must be put on the service rendered by the inventor.

> This has been done in some instances, and may be done without inconvenience in cases of very conspicuous public benefit; but in general an exclusive privilege, of temporary duration, is preferable; because it leaves nothing to any one's discretion; because the reward conferred by it depends upon the invention's being found useful, and the greater the usefulness the greater the reward; and because it is paid by the very persons to whom the service is rendered, the consumers of the commodity. So decisive, indeed, are these considerations, that if the system of patents were abandoned for that of rewards by the state, the best shape which these could assume would be that of a small temporary tax, imposed for the inventor's benefit, on all persons making use of the invention.[3]

The foregoing passage, although written nearly one hundred years ago, is still an excellent summary of the arguments against granting rewards to inventors.

It might be noted that totalitarian or controlled economies, such as communistic Russia, need not be concerned with inducements to stimulate the exploitation of an invention once it is made. Such exploitation is a function of the State, whether it be a new invention or an old established product. Consequently, the only motivation that need concern the State is in respect to the inventor, and it is the aim of the reward system to accomplish that end.

Assumptions upon which the patent system is based. In a recent article, Alfred E. Kahn [4] states that, in its strictly economic aspects, the rationale of the patent system is the

[3] Mill, *op. cit.*, Bk. V, Ch. X, sec. 4.

[4] Alfred E. Kahn, "Fundamental Deficiencies of the American Patent Law," *American Economic Review*, Vol. XXX (September, 1940), pp. 475–91.

same as that of the entire economic system of which it is a part. The following points are considered: (1) "Every person is considered to be a self-sufficient bargaining unit"; (2) "there will be equality of bargaining power and freedom in competition beyond those limits created by the patent grant itself"; and (3) "the patent law postulates a materialistic psychology, accepts the profit motive as stimulus enough to bring forth all the socially desirable inventions, and postulates personal aggrandizement as the major incentive to the individual inventor."

It has already been noted above [5] that the inventor's activities may be separated, on the basis of his functioning, into two different productive functions. One is that of the laborer; the other is that of the entrepreneur. As a laborer he "makes" the invention. As an entrepreneur he seeks to exploit it himself or to dispose of the invention to someone else who will exploit it.

The point that Kahn wishes to make is that the patent system treats the inventor as a businessman. By means of the patent grant, the inventor is given a special kind of property in his invention, which is alienable and which he can dispose of as he sees fit.

> A patent is essentially a reward for a business-man. The prospective monopoly over a trade, the exclusive right to start a business free of competition, is obviously a pecuniary expedient. The assumption must be that the inventor is also a business-man capable of exploiting his opportunity, leaving to society alone the appraisal of his efforts by the appraisal of his products.[6]

Historically, the inventor was also a craftsman and entrepreneur, capable of exploiting any new idea that he himself might develop. This is no longer true. The complexities of

[5] See Chapter II.

[6] Kahn, *op. cit.*, pp. 477–78.

the modern productive system preclude the possibility of any but a specialist successfully entering the various fields. This greatly circumscribes the inventor's field of activity. True, he may by law dispose of his patent property in almost any way he sees fit: he may "work" the patent himself, he may sell it to someone else, or he may license others to use it. But whatever he does, he must assume the role of the businessman if his invention is ever to be more than an idea. It is in this position that the patent laws consider the inventor a self-sufficient bargaining unit.

There is reason to believe, however, that in many instances the patentee is not, and cannot be, a self-sufficient bargaining unit. In many cases his patent will not stand alone, but needs the support of other patents. This condition may be due to the relationship that necessarily exists between basic and improvement inventions, or it may be because of the way that patents issue from the patent office. Each patent would be a free and independent property if only valid patents came from the patent office, but a patent carries no presumption of validity when it is issued. The invention may infringe upon some prior idea, in which case the patentee cannot stand independent and self-sufficient. For there to be a complete bargaining unit in such cases, it is necessary for the parties in conflict to pool their respective interests and proceed on that basis. This very practice has led to the formation of patent pools and cross-licensing agreements.

The second assumption which Kahn believes underlies the patent laws is the assumption that there will be equality of bargaining power and freedom of competition beyond the limits of the monopoly that is granted by the patent itself. Conditions may prevent the realization of this assumption. Powerful interests may be already established in the field to which the new invention applies. If the invention is not

something that can be made and sold to the public independently of any existing patents, there may be but a single outlet for the new invention. The only means of realizing anything on the patent may be to sell it to the existing interests, the sole interests who have any reason for bidding for the patent. Theirs is a monopsonistic position. There can be no freedom of competition under such conditions.

A patentee trying to sell his patent under such circumstances is at some disadvantage. He must deal with a monopoly on the buyer's side, or monopsony. Such a condition has prevailed in respect to shoe machinery and machinery for making glass containers.[7] In either case, anyone who had devised some improvement on the existing machines, or a new machine for accomplishing but a single phase of a more lengthy process for which a complete line of machinery was available, was forced to sell to the established interests, either United Shoe Machinery Company or Hartford-Empire Company. These two were the only companies in their respective fields. They were in a monopsonistic position in respect to the market for inventions pertaining to their fields.

On the other side of the market for such inventions there was a monopolist. In procuring a patent for his development the inventor obtained a legal monopoly. He was given an exclusive right to use his idea and, following from that, the sole right to sell the idea.

So far as there are no alternative means of accomplishing a given result, the problem resolves itself into one of bilateral monopoly.[8] "It has been evident," however, "since the days of Edgeworth that isolated exchange leads to 'undecidable opposition of interests,' and that therefore the prob-

[7] TNEC 2, pp. 377 ff.

[8] A very full bibliography on this subject may be found in Gerhard Tintner, "Note on the Problem of Bilateral Monopoly," *Journal of Political Economy*, Vol. XLVII (April, 1939), p. 263.

lem is indeterminate, in the sense that the mere condition of each party seeking its maximum advantage is not sufficient to define an equilibrium" price.[9]

Hicks has analyzed the market situation where a monopolist (A) producing a raw material, such as iron ore (or a patent on a machine or process, as in the present case), sells to a monopolist (B) producing the finished product, such as steel (or shoe machinery). He concluded that ". . . no monopoly action by A can stop B earning a monopoly profit from the consumers; he is also a monopoly buyer with respect to A. If he is allowed to do so, he will also extract a monopsony profit from A. . . ." [10] The sole possible purchaser of the types of patents here considered would not necessarily be content to get only the monopoly profit, but would also try for the monopsony profit.[11]

In all likelihood there is no equality of bargaining power either. The monopsonist's resources will ordinarily dwarf those of the independent inventor. The inequalities in bargaining power under such conditions are apparent. Also, if the inventor endeavors to enter upon production of the newly patented article, he will find that he is at a serious disadvantage in respect to bargaining power. Established producers have already obtained commitments of capital and the other factors of production, while the new patentee may find it exceedingly difficult to procure the necessary factors.

The final assumption, according to Kahn, is that ". . . the

[9] J. R. Hicks, "Annual Survey of Economic Theory: The Theory of Monopoly," *Econometrica*, Vol. III (January, 1935), p. 16.

[10] *Ibid.*, p. 18.

[11] That is, United Shoe Machinery was not content to make a monopoly profit from leasing its shoe machinery, but also exploited independent inventors by paying low prices for patents pertaining to the industry. It could lease its machines at a monopoly price because it was the only seller. It could exploit the inventors because it was the only buyer. It was a monopolist and a monopsonist at the same time.

patent law postulates a materialistic psychology, accepts the profit motive as stimulus enough to bring forth all socially desirable inventions, and postulates personal aggrandizement as the major incentive to the individual inventor." [12] Stated otherwise, the patent system is founded upon the assumption that the desire for economic reward is the dominant force motivating inventors, and that the inventions made in anticipation of this reward will promote the best interests of society. These considerations have been discussed in Chapter II, but something additional may be warranted in regard to the way the patent system directs inventive activity into those fields that maximize social well-being.

Is there any reason for believing that the patent system will so direct inventive activity that it will serve the social interest to the best advantage? Such a conclusion is hardly tenable. The patent system operates in conjunction with the price mechanism, and the price mechanism, hampered by human and governmental restrictions, has frequently failed to direct resources into the uses that maximize social ends. Pecuniary motivation is no respecter of needs. Only those who have the financial ability to make their demands effective exert any influence upon what is to be produced.

In addition, consider the effect of the patent monopoly upon prices and quantities that will be made available. Prices will be higher and quantities produced will be smaller, the extent of these departures from competitive results being greater or less depending upon the degree of elasticity characterizing the demand for the good. To grant a monopoly over a good having an inelastic demand results in a wide departure from competitive prices, and a considerable departure from the quantities that would be produced under competitive conditions. If the demand were elastic, the de-

[12] Kahn, *op. cit.*, p. 478.

parture would be relatively less, but still of considerable magnitude.

What grounds are there for concluding that the output induced by . . . [patents] has any greater claim to be regarded as "generally useful" than that which would have been induced in its absence by the price conditions of the open market? I suggest that such a conclusion runs counter to all general presumptions concerning the disposition of scarce productive resources in a regime of monopolistic control as contrasted with open competition. The nearer the market conditions approximate to pure competition, the less likely does it become that any *entrepreneur* or property owner will find it possible to influence prices by withholding supplies, and the more likely in consequence does it become that all resources, being put to the uses which maximize the incomes of their owners, will yield their greatest aggregate product. In perfect competition all production will take place at lowest cost per unit produced. How can it be argued that any departure from such a condition, induced by the grant of monopoly power to raise prices and increase a sectional income by restricting output, will achieve greater "general usefulness"?

The only conceivable line for such an argument to take would seem to be that *ultimately* the inventions of a patentable type which will be made in response to a grant of a temporary monopoly will possess of sufficiently greater general usefulness than would the results from other inventions or other output immediately foregone, to outweigh the immediate loss. There surely exists no scientific reason for making any such claim for *patentable* inventions in general, as compared with alternative output.[18]

The general patent system is hardly the method for directing inventive activity into channels of especial social importance. The monopoly grant to all patentees will not lead to specialized activities, other than specialization in those lines where the monetary return will be considerably augmented in direct consequence of the monopoly, i. e., into

[18] Plant, *op. cit.*, pp. 42-43.

fields where the demand for the goods is inelastic. It is hardly to be presumed that the demand for socially desirable goods is necessarily inelastic.

It is quite conceivable that a situation might arise in which it would be socially desirable to foster development in a special field. This end could not be achieved through the patent system unless the desired end were one that could be satisfied at a profit. In such cases it would appear justifiable to offer special inducements to attract prolonged research and experiment to the problem.[14] "A patent system applicable to inventions in general clearly cannot be justified, however, by exceptional circumstances of this kind." [15]

Even though the conclusion is that the patent system may not direct inventive activity into those channels which are of greatest social importance, there is still reason for believing that so long as inventors are motivated by the desire for economic reward the added prospect of financial return, because of the patent monopoly, will result in a greater *amount* of inventive activity. Some of this may be undesirable from the social point of view, but in all likelihood much of it can be considered a net social gain.

Reasons for the patent system. In Article I, Section 8, of the Constitution of the United States, Congress was granted 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 inventions." The clearly defined purpose of this grant of power was to encourage investigations into new fields and to assure the introduction of new things to the public.

The accomplishment of this purpose, according to the Commissioner of Patents, is attested to by the extent to

[14] See H. R. 4523. Testimony of Brigadier General William Mitchell.
[15] Plant, *op. cit.*, p. 43.

which American industry is indebted to patents. American agriculture is indebted to the gin, the reaper, the tractor, and many other machines that have all been patented. Communication has developed from the patented telephone, telegraph, and radio. In the field of chemistry there are vulcanized rubber, celluloid, and bakelite that have passed through the patent system. "In short, every industry in America . . . [is] beholden to patents." [16] The existence of the patent law is attributable to a desire to stimulate invention. It would seem from the observable evidence that it has been successful in this purpose, although there are forces other than the patent grant which have undoubtedly exerted an influence.

It is sometimes argued that the patent system was established in order to reward inventors. It appears, however, that the reward for the inventor is merely the incentive by which to secure the progress of science and the useful arts. "The patent system of the United States is based on the theory of getting information." [17] It rewards the inventor only in recognition of his services in making a new idea available to society.[18] "The community's interest in new discoveries is, theoretically, the prime consideration; the reward to the inventor is no more than a just and agreeable means to attain the desired end." [19]

Another reason advanced for the patent system is that it assures the disclosure of the invention to the public. Without the monopoly obtainable by the patent grant, the inventor would endeavor to protect his discovery by keeping

[16] TNEC 3, p. 839.

[17] H. R. 4523, p. 428. Testimony of Karl Fenning.

[18] Stephen P. Ladas, "Patents," *Encyclopedia of the Social Sciences*, Vol. XII (New York: Macmillan, 1933), p. 20.

[19] Seth K. Humphrey, "Patents and the Public," *Atlantic Monthly*, Vol. CIX (June, 1912), p. 734.

it secret. With the monopoly grant he can divulge it to the public and still retain exclusive use of it for the period of the patent. At the end of the monopoly period it becomes available for the unrestricted use of the public. By means of the patent, then, the inventor is allowed an opportunity to reap his reward from his invention, and yet the public is assured that any addition to knowledge will not die with its originator.

The patent system is the means of assuring the disclosure of new developments, thereby adding to society's fund of knowledge that may be used for future developments. In the absence of the patent system, any man has the right to make, use, and sell any article he desires, whether it is his own invention or something which some other man originated. Such being the case, no man would derive any special benefit from his own invention, once the knowledge of it became public property. In the absence of protection, such as is given by a patent, men would keep secret as long as possible any new developments they might work out. The first consideration of the patent system is the welfare of the country, and to promote that end the inventor, who is considered to have produced something of public value, is granted extraordinary privileges in return for disclosing his invention. The result is that the inventor is allowed to exploit his invention and carry on further developments behind glass walls, as it were, through which everybody can see what he is doing, although no one can get so close to him as to interfere.[20]

In this way the public comes to receive a great deal of information that it might not otherwise obtain. If inventions were retained in secrecy many of them would die with their inventors. By securing their publication in exchange for

[20] TNEC 3, p. 1083. Testimony of George Baekeland.

patent rights, however, each increment of knowledge is made available through the Patent Office, and through the years the files of the Patent Office come to be a repository of the means of applying every new principle of knowledge. All such knowledge, once the patent has expired, is open to the public to use, for ". . . the patent system operates to retain in the hands of the public rights once acquired by it." [21]

Although in all likelihood it was not the dominant reason for the original establishment of the patent system, an important reason for its continuation is that it stimulates the exploitation of new inventions. It does this by preventing competitors from making a "Chinese copy" of the new product and marketing it at a price that the inventor could not meet and still recover the costs of the original development.[22] As a result it is possible to tap additional sources of capital to finance the developmental stage.[23]

The life of an invention may be divided into three periods: conception, development, and exploitation. A patent is obtained after conception. It protects the parties at interest during the developmental period, and tends to make it possible to earn sufficient returns during the period of exploitation to recover the expenses that were incurred during the earlier stages.[24] This type of protection is especially important to new industries or business units that are established to exploit a new invention. Older, well-established firms are not in such need of this type of protection, for they have established activities which warrant extensions of credit. In some instances they would not have to procure

[21] *Ibid.*, p. 849. Statement by Conway P. Coe.

[22] *Ibid.*, p. 916. Testimony of Dr. William D. Coolidge. See also, p. 928 for a similar view held by Ralph E. Flanders.

[23] *Ibid.*, pp. 857–58. Statement by Conway P. Coe.

[24] TNEC 2, pp. 343–44. Testimony of Charles F. Kettering.

outside financing at all. The provision for a period of protection is undoubtedly of importance to the large established firm, and affects its activities, but protection can hardly be of as much consequence to it as to the new firm seeking to get its original start. After an industry is fully established it appears that patents play a minor role, although they are of considerable importance in the developmental period through which all business must pass.

Philo Taylor Farnsworth, the inventor of the basic devices that are essential to successful television, is a firm believer in the patent system. In answering a question as to how it would be possible, without the aid of the patent system, to get an enterprise such as his started he said, "Why, without the patent situation I don't see any hope of starting any such enterprise. Certainly no one can be expected to subscribe for such a large amount of money without having it protected. . . ." [25]

During its early struggles, a business finds the protection of the patent system of great assistance in meeting the problems encountered. The patent system is a shield to protect it from some of the ravages of competition which would otherwise beset it. But after it becomes established—after it has mastered the details of production and is able to operate with a high degree of efficiency, after it has achieved a substantial financial position, after it has developed its markets so that there is some assurance of a continued demand for its products—it attains a position such that continuation is possible without great reliance upon the patent system. Numerous firms that were founded upon patents have been successfully continued after the expiration of the patents.[26]

[25] TNEC 3, p. 995.

[26] *Ibid.*, p. 1098. Testimony of George Baekeland.

Some of the larger industries could probably continue in much the same way as they operate today even if the patent system were done away with. Such was the testimony of Gerard Swope, president of the General Electric Company, when asked what effect repeal of the patent laws would have upon his company.[27] William E. Levis, president of the Owens-Illinois Glass Company, also was of the belief that established business organizations could continue without the patent system, but that such a change would seriously hamper the development of new industries.[28]

Patents are sometimes used in order to control the exploitation of an important development. By means of its patents the Connought Laboratories and the University of Toronto controlled the production and sale of Insulin in the United States and Canada with the objective of placing within the means of all a thoroughly reliable and dependable product.[29]

It would oftentimes be inadequate merely to publish the facts about new inventions, intending thereby to dedicate them to the public. This is true for two reasons. First, they may fail to be utilized and made available to the public because manufacturers fear that excessive competition will meet their effort to market the products. Production of new items will not be undertaken unless there is a prospect for profits. Such prospect may be lacking unless a manufacturer is assured of the exclusive right of exploitation, which is possible if the new development has been patented.[30] Sec-

[27] H. R. 4523, p. 316.

[28] TNEC 2, p. 515.

[29] James R. Withrow, "Ownership of Intellectual Property in Educational Institutions," *Transactions*, American Institute of Chemical Engineers, Vol. XXVIII (1932), p. 205.

[30] TNEC 3, p. 883. Testimony of Dr. Vannevar Bush.

ondly, if important new discoveries are published without having been patented, some individual other than the inventor can obtain a perfectly valid patent if he applies for it within one year of the date of publication. Having obtained a patent, he might use the invention in a way of which the original inventor would not approve at all.[31] Thus, if one wishes to determine, himself, the way in which an invention is to be made available to the public, as well as to take every possible step to assure that it will be made available, it is paramount that he patent his invention.

It is sometimes alleged that when the government grants a monopoly to an inventor it thereby deprives the public of something to which the public has a justifiable claim. That was definitely the case prior to the patent systems as we know them today. In order to obtain revenue for the royal coffers, the English monarchs sold various "patent" monopolies to individuals who were then allowed the sole right to make and vend the commodities involved. Such monopoly grants often covered essential items of common use, such as salt. The grant of monopolies over items already well known to society lent itself to easy abuse. The evil effects of monopoly are well known, the outstanding points being that prices can be raised and quantities offered restricted, without any respect for social needs.

The modern patent monopoly is of an entirely different sort.[32] It takes nothing from the public that was previously known to the public. In effect, the monopoly is given to the inventor, for a limited period, for having presented something to the public which was not previously known.

The inventor in any civilized state is given an exclusive right to make and sell an economical appliance for a term of years that

[31] *Ibid.*, p. 882.

[32] TNEC 2, p. 320. Testimony of Milton Tibbets.

is long enough to pay him for perfecting it and to pay others for introducing it. Patents stimulate improvement, and the general practice of the nations indicates their recognition of this fact. They all give to the inventor a temporary monopoly of the new appliance he devises, but this monopoly differs from others in this essential fact: the man is allowed to have an exclusive control of something which otherwise might not and often would not have come into existence at all. It would not,—if the patented article is something which society without a patent system would not have secured at all,—the inventor's monopoly hurts nobody. It is as though in some magical way he had caused springs of water to flow in the desert or loam to cover barren mountains or fertile islands to rise from the bottom of the sea. His gains consist in something which no one loses, even while he enjoys them, and at the expiration of his patent they are diffused freely throughout society.[33]

A patent grant to an inventor is not, then, accurately speaking, a monopoly. A monopoly takes something from the people; a patent deprives the public of nothing which it enjoyed before the invention, but gives the community something of value by adding to the sum of human knowledge.[34] In this light it might seem logical to inquire why the right of exclusive exploitation is allowed for but a limited period. If the public is deprived of nothing by the grant of a patent monopoly, why should the inventor not be allowed an unlimited period to exercise sole and complete control over his invention?

A possible answer to such a question might be based on the idea, held by some,[35] that all inventions are a logical outgrowth of the social heritage. If this view were rigorously followed, it would not be feasible to recognize the

[33] Clark, *op. cit.*, pp. 360–61.

[34] Dudley T. Fisher, "Patents and Profits," *Scientific American,* Vol. CXX (May 31, 1919), p. 572. Also see, TNEC 3, pp. 840–41. Statement by Conway P. Coe, Commissioner of Patents.

[35] H. R. 4523, p. 935. Testimony of Felix Frazer.

contribution of any individual as being sufficient to warrant the exclusive grant for even a limited period. If it be accepted as being basically correct, but subject to the modification that the inventor adds something, though relatively small as compared to everything that has gone before, one does find some basis for a monopoly grant, but a monopoly for a limited period only. The inventor would be considered as having added enough to the common fund of knowledge to warrant some reward, but not as having added enough to allow exclusive use of the new idea in perpetuity.

Another possible explanation of the limited grant of monopoly might be based on the idea that if one man did not make the invention, another eventually would.[36] There is considerable evidence to substantiate this idea. Ogburn and Thomas investigated this topic and compiled actual illustrations showing a number of cases in which inventions and discoveries were made by two or more persons.[37] Similar conclusions were reached by Rossman.[38] A continuing patent grant may not be justifiable if there is reason to believe that a given invention will be made eventually; but a grant of monopoly for a limited period stimulates inventive activity, thereby bringing forth the invention at an earlier date, and allows the new idea to pass on to the general public before it would otherwise be invented. The net result is an acceleration of the rate of technical and social progress, the amount of the acceleration depending upon the stimulation attributable to the existence of the patent system. Insofar as this occurs it justifies the patent system.

The conclusion is that the granting of patent monopolies to inventors deprives the public of nothing previously en-

[36] *Ibid.*, p. 580. Testimony of Willis B. Rice.

[37] William F. Ogburn and Dorothy Thomas, "Are Inventions Inevitable?" *Political Science Quarterly*, Vol. XXXVII (March, 1922), pp. 83–98.

[38] Rossman, *The Psychology of the Inventor*, Ch. VIII.

joyed. It stimulates inventive activity so that the public finds entirely new things available which otherwise never would have existed, or secures them sooner than the natural course of events would have directed. To the extent that new inventions would be made within the period of the patent monopoly without the stimulation of the patent grant, the public gives up something that it could just as well retain for itself. In such cases it appears that the patent monopoly is an unnecessary "reward" for the inventor, granted at the expense of the consuming public. As for inventions that result solely from inventive activity induced by the prospect of monopoly profits, the public experiences a net gain, and the patent grant of monopoly can justifiably be considered as an effective incentive.

CHAPTER IV

THE AMERICAN PATENT SYSTEM

THE American patent system is almost unique among the various patent systems of the world. Historically, they all have a common origin in the English Patent. The conditions surrounding the development of the American patent system, however, have resulted in distinguishing characteristics. These enhance the role which the patent system plays in the American economy.

History of the patent system. England entered upon an early policy of encouraging trade and industry which subsequently became the pattern for the American patent system. As early as 1440 English letters patent were granted for a method or process of manufacturing salt.[1] Oftentimes, however, such grants of monopoly were not to encourage invention and business activity, but were resorted to by destitute monarchs as the only remaining means of rewarding court favorites or of obtaining additional revenues.[2] In such cases monopolies were granted over existing industries.[3] These monopolies were exceedingly unpopular and resulted in the passage of the Statute of Monopolies in 1623.

[1] "Patents and Inventions," *Nature*, Vol. CXXXIII (February 3, 1934), p. 183.

[2] H. R. 4523, p. 539. Testimony of Willis B. Rice.

[3] Harrison E. Howe, "Importance of Inventions to Civilization," *Centennial Celebration of the American Patent System: 1836–1936* (Washington: Government Printing Office, 1937), p. 5.

In effect, the statute stated that the Crown should not have the power to grant a monopoly for any purpose, except such as applied to new manufactures or inventions. This exception was the foundation of the patent system of Great Britain, which has been the model for the patent systems of industrial countries throughout the world.

The American colonists were familiar with the English patent laws, and to some extent the colonists granted patent monopolies such as are known today.[4] The colonial patents, however, were unlike modern patents in that they were issued only by special acts of the legislatures. "The first patent on this continent was granted by the Massachusetts General Court to Samuel Winslow in 1641, for a novel method of making salt. The first patent on machinery was granted by the same Court to Joseph Jenkes in 1646, for a mill for manufacturing scythes." [5]

When the Constitutional Convention met in Philadelphia, the attributes of patents were well known. Provision was made for the protection of inventions in both the Virginia plan and the New York plan, in spite of differences in the basic philosophies underlying those two proposals.[6] The committee on style phrased the patent powers of the Federal government in the following words: "The Congress shall have 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." [7] "Contemporary records of the debates

[4] *General Revision of the Patent Laws.* Hearings before the Committee on Patents, House of Representatives, 72d Congress, 1st Session, Government Printing Office (1932), p. 2. Testimony of Karl Fenning.

[5] U.S. Department of Commerce, *The Story of the American Patent System: 1790–1940* (Washington: Government Printing Office, 1940), p. vii.

[6] *General Revision of the Patent Laws* (1932), p. 2.

[7] Constitution of the United States, Article I, Section 8.

in the Constitutional Convention and of the great popular discussion which preceded the adoption of the Constitution by the several states show that this clause of the Constitution was accorded the almost unique distinction of universal approval." [8]

In a message to the First Congress, Washington suggested that appropriate legislation be enacted to carry into effect this clause of the Constitution. He expected Congress to give protection not only to new inventions, but also to newly imported industries, which were very much needed in the United States at that time.[9] Such a concept of invention had prevailed in England for some time, England having made considerable effort to attract new industries from the highly developed industrial area of the Low Countries on the Continent. "The word 'invent' is derived from the Latin and means 'bring-in.' The purpose of the early English patent was not so much to encourage the psychology of invention in the sense that we understand it today as to encourage the bringing in of industries from other countries." [10] The Congress, however, in its first patent act of 1790, not having any authority to give protection to importations, limited its applicability to inventions as popularly understood today. All subsequent acts have been similar in this respect.

The statute of 1790 placed the burden of granting patents upon a committee made up of the Secretary of State, the Secretary of War, and the Attorney General. As Secretary of State, Thomas Jefferson was in effect the first administrator of the American patent system—his department having been assigned the task of administering the patent laws.

[8] Gilbert H. Montague, "The Sherman Anti-Trust Act and the Patent Law," *Yale Law Journal*, Vol. XXI (April, 1912), p. 434.

[9] *General Revision of the Patent Laws* (1932), p. 3. Testimony of Karl Fenning.

[10] H. R. 4523, p. 620. Testimony of Lawrence Langner.

Although monopolies were generally repugnant to the ideals of Jefferson, he eventually came to favor the patent system, as evidenced by his words in a letter to Madison.

> An act of Congress authorizing the issue of patents for new discoveries has given a spring to invention beyond my conception. Being an instrument in granting patents, I am acquainted with their discoveries. Many of them indeed are trifling, but there are some of great consequence, which have been proved of practice, and others which, if they stand the same proof, will produce greater effect.[11]

New legislation was passed in 1793 which made no provision for any search as to novelty or patentability. Patents were issued upon receipt of an application, almost as a matter of course, as had been the custom in England. Under such a "registration" system, which replaced the original "examination" system, the whole question of validity was made a matter of court adjudication. The statute of 1836 established the system as it is known today. It charged the Commissioner of Patents with the task of examining every patent application to determine the novelty of the claimed invention. The act of 1836 established a system of patent law that, although built upon everything that had come before it, was practically without precedent in history. It has served in its main outlines as a model for the patent systems adopted by most of the industrial countries of the world.[12]

Features of the present patent law. An American patent is a grant issued by the Federal government giving an inventor the right to exclude all others, for a period of seven-

[11] Quoted in *Centennial Celebration of the American Patent System: 1836–1936*, pp. 28–29.

[12] For a brief résumé of the changes that have been made in the patent laws since 1836, see the testimony of Karl Fenning in *General Revision of the Patent Laws* (1932), pp. 23–24. For a more extended outline of the changes see *The Story of the American Patent System: 1790–1940*.

teen years, from making, using, or selling his invention within the United States, its Territories, and the Canal Zone, and, upon compliance with certain regulations, in Puerto Rico, the Philippine Islands, the Virgin Isles, and Guam. The term of a patent cannot be extended except by special act of Congress. After the expiration of the seventeen-year period the subject matter of a patent becomes public property, subject to exploitation by anyone.

A meaningful definition of patentability is difficult to phrase. It must follow from the law, which is:

> Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, or who has invented or discovered and asexually reproduced any distinct and new variety of plant, other than a tuber-propagated plant, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof or more than one year prior to his application, and not in public use or on sale in this country for more than one year prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor.[13]

There are a number of things that cannot be patented. A newly discovered scientific principle cannot be patented —only the application of the principle. A patent cannot be obtained on a useless device, on printed matter, on a method of doing business, on an improvement in a device which is the result of mere mechanical skill, nor for a machine which will not operate, particularly for any alleged perpetual motion machine. The patent office has the privilege of requiring

[13] United States Code, Title 35, Section 31, as amended by Act of May 23, 1930, 46 Stat. L. 376, and Act of August 5, 1939, 53 Stat. 1212.

working models of any machine for which a patent is desired, and this means is availed of to discourage "inventors" of perpetual motion. The Patent Office would not consider airplane patents before the Wright brothers demonstrated the possibility of flying.[14] When the invention is of a composition of matter, the applicant may be required to furnish specimens of ingredients and of the composition sufficient in quantity for the purpose of experiment.[15]

To obtain a patent, one must show that there has been an invention; that the invention is useful; that it is not vicious or against public policy; and that it is new.[16] Any rules for determining whether or not invention is present in any given case are at best rough and ready objective tests. In the final analysis the courts, to which appeal can be had if the Patent Office refuses a patent, actually look to the mental process of the inventor to determine whether he used his "inventive faculty." [17]

Design patents, as distinguished from patents for other types of inventions, may be obtained for any new, original, and ornamental design for an article of manufacture. The inventor has a choice of a patent running for three and one-half, seven, or fourteen years if his invention is a design. The total fees payable to the Patent Office for design patents of the different periods are ten, fifteen, and thirty dollars, respectively. The fees for mechanical patents total sixty dollars, thirty dollars payable at the time application is made, and the balance at the time of issue.

Government employees, except those in the Patent Office,

[14] H. R. 4523, p. 109, testimony of Roy Knabenshue and pp. 114–15, testimony of Thomas E. Robertson.

[15] United States Code, Title 35, Section 34.

[16] Milton Wright, *Inventions and Patents* (New York: McGraw-Hill, 1927), pp. 15–16.

[17] Rossman, *The Psychology of the Inventor*, p. 26.

may obtain a mechanical patent, but not a design patent, without the payment of any fees when the head of their department or independent bureau certifies that such an invention is used or is likely to be used in the public interest. To get this preferential treatment, however, one must stipulate in the application and include in the patent that the invention may be manufactured and used by or for the government for governmental purposes without the payment of any royalty.[18] This enables the inventor to exploit his idea privately in any way he sees fit, while allowing the government free use of it for its own purposes.

Whenever the United States is at war, the Commissioner of Patents is empowered to withhold the grant of a patent and maintain the secrecy of the invention until the termination of the war. When the government uses such an invention, for which a patent is ultimately issued, the inventor has the right to sue the government for compensation in the Court of Claims, the right to compensation starting from the date of the use of the invention by the government.[19]

Role of the American patent system. A patent is a legal monopoly granted on the theory that it will promote the progress of science and the useful arts. The terms of that monopoly were originally defined in the patent laws enacted by Congress, but they have subsequently been greatly modified by judicial interpretations, and further modified by practices that have developed in the business community.

The patent law is not the same thing as the patent system. Our legal method of fostering technological advance is an ancient structure, almost the same, basically and in detail, as it was three hundred years ago. But the economic institutions which have grown up around this venerable legal framework have so radically changed that it is difficult to believe that the

[18] Act of April 30, 1928, 45 Stat. 467; 35 U.S.C.A. 45.
[19] Act of October 6, 1917, 40 Stat. 394; 35 U.S.C.A. 42.

same law could possibly apply in the manner originally intended to the new situation. In fact it does not. Economic change, motivated by the dynamic quest for profit, can use law, modify it, or ignore it. The resultant system may be more or less socially beneficent, more or less effective in accomplishing its original purpose; in any event it will be different from that originally contemplated by the unchanged legal prescriptions.[20]

The patent laws have been changed many times since the first patent act was passed in 1790. The laws, and the system surrounding the laws, were inordinately simple, but from such simple beginnings has developed the highly complicated structure of the present. Today, the American patent system is one of the most complex patent systems to be found in any country. Its very complexity, however, is an index of inventive activity and industrial development.

I would further add, as an interesting comment, that those countries which have the most complex patent systems have the greatest quantum of invention and the highest wage scales, while those countries which have the simplest patent systems or no patent systems at all, have the least invention and the lowest wage scales, as witnessed in China; in other words, there is a definite relationship between the complexity of the patent system, the amount of inventive effort performed by a country, and the labor wage scale of the country. The moment the standards of living rise, the incentive to invention becomes greater, and with the multiplication of inventions, the complexity of the patent system tends to increase. I, therefore, feel that the complexity of our United States patent system is often wrongly interpreted as indicating a restriction upon inventive effort, whereas it is actually a symptom to the contrary.[21]

It has been held that the American patent system fosters intangible qualities which are considered characteristic of American society. Dr. Vannevar Bush, president of the

[20] Kahn, *op. cit.*, p. 475.
[21] H. R. 4523, p. 627. Testimony of Lawrence Langner.

Carnegie Institution, believes it promotes the spirit of democracy by offering every individual the same opportunity, irrespective of his place in society. Every inventor appears before the Patent Office as an individual and receives the same consideration as all other individuals.[22] A similar belief is held by Lawrence Langner, who sees the American patent system spreading American democratic ideals throughout the world. The products of American inventive genius have been manufactured en masse and sold throughout the world without encountering much competition from European countries, where so many of the articles in common use in the United States have never been considered other than articles of luxury.[23]

The patent system is also considered to be a spiritual influence, first by fostering the pioneering spirit which has dominated so much of American history. Although the geographical frontiers have disappeared, the frontiers of technology have remained to challenge the imagination. "That pioneering spirit, that willingness to take a chance, has been very important in our industrial advance. The existence of the patent system has made that work possible in industry; it has implemented the ingenuity, the resourcefulness, and courage of our people. . . ." [24] Secondly, it fosters the pursuit of the ideal, which, though it fails to recompense the innovator, does enrich the societal culture of which he is a part.

> . . . we shall err if we appraise patented inventions merely in terms of utility and success. Their commercial value and their celebrity are not their sole merit. They symbolize a spirit that enriches the world though it fails to recompense the inventor. That spirit is one of patience, resoluteness, sacrifice—suffering,

[22] TNEC 3, p. 873.
[23] H. R. 4523, p. 626. Testimony of Lawrence Langner.
[24] TNEC 3, p. 871. Testimony of Dr. Vannevar Bush.

too, if need be—in the pursuit of an ideal. Abraham Lincoln was one of those inventors who failed, if by that we are to understand that his invention brought him neither financial return nor great renown. But I like to think that his was the true inventor's spirit, which moved him to invent a boat designed to carry its burden, including human beings, safely over dangerous shoals. Only a few years later that spirit was to sustain him in guiding the ship of state through a tragic storm.[25]

Differences between American and foreign patent laws. The patent laws of the United States are the most liberal of any country in the world. The monopoly grant is absolute and unconditional. The total costs of procuring and maintaining the patent are the lowest of any country.[26] These conditions could not but affect the amount of invention, which is evidenced by the fact that the United States has issued more patents than any other country. Some of the points of difference between the American laws and those of foreign countries are to be noted:

A. Patents are granted only to inventors
B. Interference proceedings distinguish the American system
C. Patents are granted without opposition
D. Taxes on patents, nullity suits, working laws, and compulsory license laws do not exist in the United States
E. Other differences

A. In several foreign countries the first man to apply for a patent on a new idea gets the patent regardless of whether or not he is the inventor. In the United States the true and first inventor is given ample time to work out the details of his invention without fear that someone can steal it by

[25] *Ibid.*, p. 863. Statement of Conway P. Coe.
[26] H. R. 4523, p. 618. Testimony of Lawrence Langner.

rushing an application to the Patent Office ahead of him. Consequently, ". . . as compared with the foreign patents, the patents granted by the United States Patent Office more generally relate to well-worked-out inventions rather than half-baked and uncompleted ideas which have not been properly developed." [27] Furthermore, the United States Constitution provides that inventions can only be patented by their inventors, whereas in other countries it is possible for corporations to take out patents in the name of the corporation so that the name of the inventor may never appear in connection with the patent. The United States provisions would seem to offer greater incentive for individual inventive activity, because of the possibility of personal recognition.

B. With the exception of Canada, foreign countries have no practice at all corresponding with the interference practice of the United States Patent Office.[28] This is explainable by the presumption, in foreign countries, that the first person making application for a patent is the inventor. In the United States, however, the date of application is incidental, and the interference proceedings within the Patent Office are for the purpose of determining just who the first inventor is in case there are two or more applications for a patent on the same idea.

C. According to the laws of most foreign countries, after the patent application has been allowed by the Patent Office it is thrown open to "opposition." In some respects this replaces the interference proceedings in the American system. Under the "opposition" practice, the specifications of the patent are published by the Patent Office before the patent is actually issued, and during a period of from two

[27] *Ibid.*, p. 616. Testimony of Lawrence Langner.
[28] *Ibid.*

to three months any interested party may file his objections to the grant of the patent. The ostensible purpose is to assure the issuance of valid patents. This practice amounts to what is for all practical purposes a litigation proceeding, and exists, or did exist, in Great Britain, Germany, Holland, Denmark, and Czechoslovakia.[29]

The "opposition" practice is subject to serious abuses, one of particular import being that it can be used as an instrument of blackmail. Such a condition was revealed in a statement by Lawrence Langner, international patent solicitor. "I would say in 5 cases out of 10, where an opposition is filed in certain countries, we get a letter from the foreign manufacturer saying if we will give him a free license he will withdraw his opposition." [30] However, the number of oppositions filed is only 3 to 5 per cent of the patent specifications that are published ". . . and probably not more than a quarter of those filed are successful," [31] so that the "racket" is not as serious as might be suspected.

D. The patent laws of foreign countries provide for the payment of annual taxes by the patent owner on penalty of forfeiture of his patent. There is something to be said in favor of such taxes for they tend to wipe out, after a few years, those patents that are of no particular value, for no one will pay taxes on them unless they are worth retaining. This may clear up conflicting situations and enable exploitation of the remaining patents. It is alleged, however, that these taxes make a very heavy burden for professional inventors to bear.[32] Such a situation might discourage their continued activity, but it would seem that if their inventions were of no value they would allow them to lapse, while if

[29] TNEC 3, p. 1014. Testimony of Lawrence Langner.
[30] H. R. 9259, p. 411.
[31] H. R. 4523, p. 645. Testimony of Karl Fenning.
[32] *Ibid.*, p. 618. Testimony of Lawrence Langner.

they were of value the returns from exploitation would enable payment of the taxes.

In this connection, it might be noted that the initial fees charged for patents by many foreign countries are much less than those charged by the United States. Roughly, the amount of taxes for the first five years taken together with the application fee in England, France, and Germany is just about equal to the total fees charged by the United States Patent Office [33]—sixty dollars. In the United States, however, no further payments have to be made after issuance of the patent, while in these foreign countries annual taxes have to be paid continuing throughout the life of the patent grant, so that the total cost of a foreign patent is considerably above that for an American patent if both are to be maintained for the entire period of the grant.

Another foreign practice differing from that followed in the United States is in respect to nullity or revocation suits. These proceedings consist in bringing an action before the law courts requesting that the patent be invalidated for reasons such as lack of novelty, lack of invention, et cetera. In Germany, for example, such suits can be brought within five years from the date that the patent is issued. If the patent is not nullified during this five-year period, it automatically becomes valid for the entire term of the patent. Although it is possible for a court subsequently to give its claims a narrower interpretation, no court can invalidate the patent.[34] That is, the validity of a German patent cannot be attacked after the first five years, while the validity of an American patent can be contested at any time during its life of seventeen years.

There are no provisions in the American patent laws

[33] *Ibid.*

[34] *Ibid.*, p. 619. Testimony of Lawrence Langner.

concerning compulsory working or compulsory licensing of patented inventions. Such provisions are common in foreign countries, their purpose being to guarantee that new industries will be developed within the countries.

> The main purpose, for example, of the British working laws and the British compulsory license laws . . . is not that one English industry can get the invention away from another English industry which is suppressing it, but it is in order that English industry can stop an American industry or a French industry or a German industry from taking that patent in England, using it to stop the invention being adopted in England, and then dumping into England products made in the United States, France, or Germany, as the case may be.[35]

The compulsory licensing provisions are applied to English subjects occasionally, however, as a means of combating restraints upon trade that are considered to be inimical to the public interest.[36]

Compulsory working and licensing provisions were originally adopted to assure a country's industrial development. The United States achieved this end through its system of protective tariffs. More recently these two provisions have been suggested as means of combating monopoly and of increasing employment by ensuring the working of all inventions. But whatever the end in view, compulsory working and licensing provisions should be recognized as subtracting from the patent monopoly, consequently decreasing the reward for inventors and the incentive to invent, and making exploitation more hazardous.

There is a provision in the English patent law providing for "licenses of rights." Upon the request of the patentee the patent office will indorse the words "license of rights"

[35] *Ibid.*, p. 620. Statement of Lawrence Langner.
[36] *Ibid.*

upon the patent. Such indorsement gives notice that the patentee stands ready to grant a license for the use of the patent, and that, if the prospective licensor and licensee cannot agree upon satisfactory terms, the patentee will abide by such terms as the Comptroller in the patent office may determine. Use of the "license of rights" provision makes it unnecessary for foreigners to work their patents in England.

Many South American countries issue "confirmation patents." These are predicated on the grant of a patent in some foreign country, thereby eliminating much search of the prior art to determine novelty and patentability. Application for a confirmation patent has to be made before the invention is put to use in the "confirming" country.[37]

The German patent law provides for a system of minor patents known as *Gebrauchsmuster*, issued originally for three years, but renewable for a second three-year period. The *Gebrauchsmuster* is utilized for the protection of inventions possessing only a slight degree of novelty or patentability, for which an ordinary German patent would not be granted. It cannot be used to cover a method or process. One of the chief merits of the *Gebrauchsmuster* is the alacrity with which it can be procured, the total time required being but a few weeks, as compared with the three years that it usually takes to obtain a patent in the United States. Such speed of issue is obtained because the *Gebrauchsmuster* is not examined as to novelty, but is merely registered.[38]

[37] George Von Gehr, "A Survey of the Principal National Patent Systems from the Historical and Comparative Points of View," *John Marshall Law Quarterly*, Vol. I (June, 1936), pp. 394–96.

[38] *Ibid.*, pp. 381–84.

CHAPTER V

PATENT MONOPOLY AND THE ANTITRUST LAWS

INVENTORS have always had the right to make, use, and vend their inventions, even without a patent. These are rights at common law, requiring no specific grant from the government. The inventor also has a right to deprive the public of the benefits of his invention by keeping it secret. These are inalienable rights of the inventor without regard for the patent law. On the other hand, the public has a common law right to make, use and sell anything about which it has sufficient knowledge. The inventor can seek redress under the common law only if others secure knowledge of the invention through fraud or breach of faith. The common law does not recognize the inventor's exclusive right in his invention.[1]

The making of an invention does not of itself confer upon the inventor any exclusive right with respect to its production, use, or sale. Such a right can only be acquired by a grant from some sovereign authority, and such right as may be granted is only a negative right of excluding others.[2] A long line of cases sustains the legal right of the patentee to exclude all others from making, using, and selling the pat-

[1] Forest R. Black, "The Patent Way to Balance the National Budget," *American Political Science Review*, Vol. XXIX (October, 1935), p. 831.

[2] *Minnesota* v. *Barber*, 136 U.S. 313 (1890).

ented product or process.[3] A subsidiary right flowing from this is the right of the inventor to use his own invention unmolested by others claiming it as their own.

Extent of the Patent Monopoly

Conflicting philosophies with a common purpose. The ideal which most societies pursue is the maximization of consumable goods and services, as far as economic ends are concerned. Various means of accomplishing this objective have been tried at different times; but, regardless of the methods employed, the efforts have been to obtain the greatest possible production and the widest possible distribution. The maintenance of free competition has been the policy usually advocated by economists since the days of Adam Smith.

The State, as the agency through which society expresses itself in this respect, has made numerous excursions away from the policy of *laisser-faire,* but it has been guided by the belief that the ideal situation was freedom of competition. Free competition, however, is frequently inimical to the interests of individual industrialists and financiers, and they have often taken things into their own hands. The resulting practices and forms of business organization have failed to secure maximum output and equitable distribution. As the situation has become more and more noticeable to observers, the State has felt called upon to take action in order to preserve free competition. This meant the sacrifice of the ideal of *laisser-faire.* As it has been realized that *laisser-faire* and

[3] *U.S.* v. *American Bell Telephone Co.,* 167 U.S. 224 (1897); *Continental Paper Bag Co.* v. *Eastern Paper Bag Co.,* 210 U.S. 405 (1908); *Henry* v. *A. B. Dick Co.,* 224 U.S. 1 (1912); *Bauer* v. *O'Donnell,* 229 U.S. 1 (1913); *Motion Picture Patents Co.* v. *Universal Film Manufacturing Co.,* 243 U.S. 502 (1917); *U.S.* v. *United Shoe Machinery Co.,* 247 U.S. 32 (1918) and 258 U.S. 451 (1922).

free competition are not necessarily companion pieces, the former has been sacrificed in an effort to maintain the latter.

> Social control of economic activity is as old as private property. Laissez faire is itself a policy of social control. The contrast between economic planning and laissez faire lies in the nature and scope of the economic functions to be centralized in the state. . . .
>
> The anti-trust laws . . . were an attempt to maintain competition by law. The Sherman Law prohibited monopolies and restraint of trade, and the legislation of 1914 was intended to implement this policy by somewhat elaborating and clarifying the meaning of "restraint of trade" and improving the machinery for administrations.[4]

The continued adherence to the ideal of a competitive economy, as opposed to an economy dominated by monopolies, is founded upon the results that can be expected to accrue from each. "Monopoly not only restricts the total output of society, but also enlarges the share (and the absolute amount) of that total obtained by the monopolist." [5] Competition, on the other hand, ensures that the people get the kinds of commodities and services that they want, in the long run, at prices not far from the cost of production. Monopoly holds no such promise. The monopoly price will always be somewhat higher, and it may be very much higher, than cost of production, and the monopoly is not under so strong inducement to produce the kind of goods that people want.[6]

[4] Arthur Robert Burns, *The Decline of Competition* (New York: Mcgraw-Hill, 1936), pp. 522–23.

[5] *Ibid.*, p. 560.

[6] The fact that price will be higher and output smaller under monopoly conditions than under competitive conditions can be seen on Chart A, where average total cost (ATC), marginal cost (MC), demand or average revenue (AR), and marginal revenue (MR) have been plotted. (Chart A is intended to represent a general case. Although the shape of the curves might vary, the general relationships would be the same.) If competition

Monopoly also results in a smaller return to the factors of production that are employed. This can be demonstrated by taking labor to represent all the factors of production. Wages tend to be determined by the marginal productivity of labor. The only concept of marginal productivity that has any meaning in this connection is referred to as marginal revenue product. Marginal revenue product is the net addition to total income attributable to the productive process. The marginal revenue product is equal to the total income obtained by selling the goods produced by X laborers *minus* the total income from the sale of the goods that X–1 laborers would produce. The difference is attributable to the activities of one laborer. It is stated in terms of money, the usual medium in which wages are paid.

The demand curve for the product of an individual firm in a competitive industry is a horizontal line. The price obtainable for the product is constant for the full range of a competitor's possible output. The sale of the product created by added laborers does not reduce the price that the individual firm receives. Therefore, wages tend to be equal to the figure obtained by multiplying the added product at-

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prevailed, output would be ON units and the price would be NP. This would maximize the returns to the competitors, for at NP output marginal cost for the individual firm would be equal to marginal revenue for the firm. (For an individual firm in competition, the demand curve would be perfectly elastic, or horizontal, as BP, so that marginal revenue and average revenue would be equal.) If but a single firm existed to satisfy the given demand—a monopoly situation—output would be but ON′ units and price would be N′P′. This scale of operations would bring the monopolist the maximum net returns, as determined by the intersection of the marginal revenue and marginal cost curves at A. If the scale of operations were less than ON′ units, marginal revenue would be greater than marginal cost; while if more than ON′ units were produced, marginal revenue would be less than marginal cost, i. e., the addition to total income from the sale of the product would be less than the added cost incurred to produce the added output.

tributable to an added laborer by the prevailing price at which the goods can be sold.

When a monopoly is the employer, the situation is quite different. A monopolist's demand curve slopes downward and to the right. The monopolist can only sell greater quantities of his monopolized good by accepting lower prices.

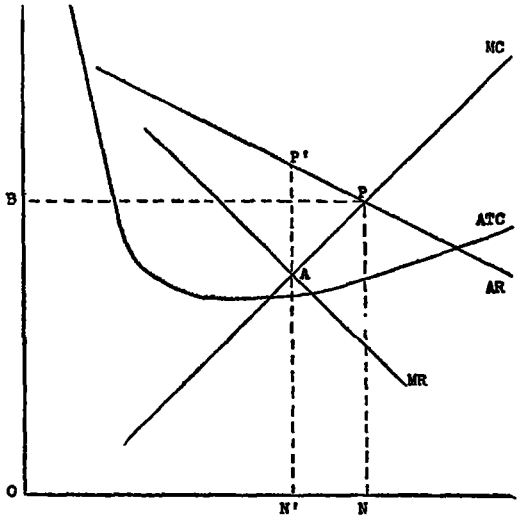

CHART A

DETERMINATION OF OUTPUT AND PRICE
UNDER CONDITIONS OF MONOPOLY AND COMPETITION

Additions to total revenue are less than the price at which larger quantities can be sold because of the decline in value of the total supply previously produced. The monopolist's added income is always less than the price because of the slope of the demand curve. Wages still tend to be determined by the marginal revenue product, but the total income from the sale of the greater product when more labor is employed

is relatively less on account of the lower price that must be accepted for the entire output. Consequently, wages, and the returns to the other factors, are less when monopoly conditions exist than when competition prevails.[7]

Restraint of trade, which is the *modus operandi* of a monopolist, has always been illegal at common law, but the common law did not restrain the sovereign power of the State from granting monopoly powers in such fields as it saw fit. The abuse of this power by the English monarchs led to the passage of the Statute of Monopolies in 1623. This statute specified that no monopoly grants were to be extended by the monarch, with but a single exception. The exception allowed was what has come to be known as a patent: a grant of monopoly for a limited period to an inventor as an encouragement to inventive activity. This exception was predicated on the belief that new inventions would tend to augment the total amount of consumable goods and services available to the public, and should consequently be encouraged, even at the expense of forfeiting for a limited time, the ideal of free competition.

The English system has been the pattern for the American system. The Federal government was given the power by the Constitution to make patent grants of monopoly for limited periods in order to encourage inventive activity. No counter-monopoly measures were adopted at that time. Mo-

[7] This fact has been presented by Professor H. L. McCracken, *op. cit.*, pp. 166–67.

The above argument can be stated in technical language as follows: Wages tend to be determined by the marginal revenue product of labor. Marginal revenue product is calculated by multiplying the product attributable to an added laborer by the marginal revenue. Marginal revenue is always less than average revenue for a monopolist. Therefore, marginal revenue product is less for a monopoly than for a firm selling in a competitive market, and the monopoly will pay lower wages. See Edward Chamberlin, *The Theory of Monopolistic Competition*, 3d ed. (Cambridge: Harvard University Press, 1938), Ch. VIII.

nopolies were not a problem, and it seems to have been the belief that the common-law provisions were sufficient to care for such situations as might develop. Originally, then, free competition, as it would exist under a *laisser-faire* development, was conceived to be the proper means of obtaining a maximum of consumable goods and the best possible distribution of those goods. Reliance is still placed upon free competition, but the principle of *laisser-faire* has been found wanting.

We are faced at the outset with a fundamental contradiction. The patent system creating monopolies of individual inventions is today at the roots of our economic system. This individual monopoly is created by Government and enforced by the courts for the public welfare; competition is wholly inconsistent with this principle. On the other hand, we are living in a competitive society in which the only force relied upon to regulate production, distribution, the quality and prices of goods is competition, and all monopolies are inconsistent with such a system because they are the antithesis of competitive control and for this reason it has been one of the objects of government since before the Christian era to destroy them.

We find, therefore, that we are deliberately creating by law a certain type of monopoly in the belief that it is beneficial, while at the same time we recognize that all monopolies are the enemies of our competitive society and yet the one type of monopoly flows and merges into the other type by almost imperceptible degrees.

The patent system, as originally designed, apparently operated well under the conditions in which it was created, but under modern economic conditions a different situation arises.[8]

The antitrust laws have been enacted as declaratory statutes reinforcing the common-law provisions against restraint of trade in an effort to remedy the situation. The antitrust laws are an effort to legislate the continued existence

[8] H. R. 4523, p. 1162. Report by Willis B. Rice.

of free competition. They have not, however, interfered in any way with the patent grant of monopoly, so long as the patent monopoly is not abused, but used in the way originally intended.

Controls consistent with the patent grant. The holder of a patent is given a monopoly by the government over the manufacture, use, and sale of a particular new invention. He is given a wide latitude of choice in the exploitation of his invention.

> A patent is a legal monopoly granted on the theory that it will promote the progress of science and the useful arts. The law at present affords to the patent owner such a wide choice in exploiting a new industrial art that it offers wide opportunities for the restraint of trade. These opportunities are facilitated by the technical complexity of patent law, the costs of litigation, and the ever-present problem of drawing a sound line between the legitimate use of patents and the uneconomic extensions of that privilege.[9]

The fact that the patent grant of monopoly is an exception to the adherence to a competitive economy has already been noted. The enforcement of the antitrust laws is the prevailing method of assuring that competitive conditions will prevail. This immediately raises the question as to how far the patent owner may go in the exploitation of his monopoly without coming into conflict with the antitrust laws. The question cannot be categorically answered, for there is practically no declaratory law on the subject.[10] Every question of conflict between the patent monopoly and the antitrust laws must be determined by the judiciary, and the courts have been no more consistent in this field than in many others. Although a number of conflicting opinions

[9] TNEC 2, p. 256. Statement by Thurman Arnold.

[10] The only statutory limitation on the patent monopoly is found in Section Three of the Clayton Act, 38 Stat. 730 (1914); 15 U.S.C.A. 14.

have been handed down, it may be stated that *a conflict arises only when the patent law and the rights granted under it are used as a guise or device to conceal a combination which in its very nature violates the antitrust laws.* "The so-called conflict is not so much a conflict of the laws themselves as it is a difficulty in determining the rights which are granted by a patent and those outside of these rights, which are, of course, subject to the general law." [11]

It was, of course, inevitable that there should be a clash between the patent statute which employs "the language of complete monopoly" and the anti-trust laws, to which monopoly is anathema. From the start it was questioned whether the patent right, no matter how extended, could be subject to the "general law," and in one important case it was contended that the Clayton Act was an unconstitutional limitation upon the rights secured to a patentee under the laws of the United States. (United Shoe Machinery Corp. v. United States, 258 U.S. 451, 1922.) Despite the language of the patent law, the decisions of the courts indicate their tendency throughout the years to circumscribe the patent monopoly. The cases in point present an exciting chapter in a field of law, which, because it more and more transcends the lawyer's study and reaches out into the social and economic life of the nation, is unfortunately too little known.[12]

The extent of the monopoly allowed to the holder of a patent can best be measured by the amount of control that he may exercise over the product after it enters commercial channels or over those he licenses to use the patent. While this is not always easily discernible, there is a sufficient line of cases concerning some practices to warrant conclusions regarding them. Attention is directed to some of the controls

[11] Horace R. Lamb, "The Relation of the Patent Law to the Federal Anti-Trust Laws," *Cornell Law Quarterly*, Vol. XII (April, 1927), p. 273.

[12] Mortimer Feuer, "The Patent Monopoly and the Anti-Trust Laws," *Columbia Law Review*, Vol. XXXVIII (November, 1938), pp. 1146–47.

that appear to be consistent with the patent monopoly.

There is one method, and apparently only one, by which the patent owner can specify the retail sales price of the patented product. This is by resort to consignment sales. It has been held not to be a restraint of trade for a patentee of electric light bulbs to designate a retailer as his selling agent with instructions to the agent to sell the bulbs at a specified price.[13] "This is the only way by which a patentee may dictate the price at which the patented article may be sold . . ." [14] unless he sells directly to the consumers through his own retail outlets, or refuses to deal with firms failing to "cooperate." [15]

None of these controls exist as a part of the patent monopoly. They are available alike to manufacturers operating with or without patents. This is true of the recent retail price maintenance laws enacted by many states and by the Federal government,[16] under which ". . . trade-marked, branded, or named articles, whether or not, and regardless of being, patented, can be privately, not legislatively, restricted on resale as to price." [17]

One of the controls that the patent monopolist most desires appears to be control of the price policies of his licensees. This is particularly desired when nonexclusive licenses are granted. Nonexclusive licenses allow some degree of competition among the licensees. Where the introduction of an invention requires a large initial investment, anticipated competition from fellow licensees might restrict the devel-

[13] *U.S.* v. *General Electric Co.*, 272 U.S. 476 (1926).

[14] Bernard Axler, "Trusts and Monopolies—Patents," *Air Law Review*, Vol. VI (April, 1935), p. 188.

[15] *Frey and Son, Inc.* v. *Cudahy Packing Co.*, 256 U.S. 208 (1921).

[16] The Miller-Tydings Act, 50 Stat. 693 (1937); 15 U.S.C.A. 1.

[17] Morris D. Forkosch, "The Economics of American Patent Law," *New York University Law Quarterly Review*, Vol. XVII (January, 1940), p. 190.

opment of the invention unless all the licensees could be required to abide by an agreed-upon price policy. Otherwise competition would develop between the licensees, and the necessary prospect for a speculative profit would not exist.[18]

When the patent owner licenses a manufacturer to work the patent under a true license agreement, transferring to the manufacturer something less than title to the patent, the patentee can retain the right to control the price at which the licensee sells the goods so manufactured. This can be legally done only if the owner-licensor conveys less than title to the patent or to any part of it. If the patentee conveys title to the patent, the licensee then owns a share in the patent monopoly, and it is presumed that he will watch over it with as much interest as does the patentee, thereby making it unnecessary for the patent owner to exercise control over prices to protect the value of his monopoly.

The legal authority usually cited by those who would allow the patent owner to control the prices charged for the good manufactured under the patent is *U.S.* v. *General Electric Co.*[19] The case is of sufficient interest and importance to warrant consideration.

There were two points involved in the General Electric case, both having to do with price fixing. The first point of importance was the determination of the legality of the method of consignment sales to enable the patent owner who was manufacturing the patented item to dictate the prices at which it might be sold in the retail market. This part of the decision has been noted above.

The second important question decided in this case had to do with the right of the patent owner to dictate the prices at which the licensee might sell items manufactured under

[18] TNEC 3, p. 891. Testimony of Dr. Vannevar Bush.
[19] 272 U.S. 476 (1926).

the patent. The General Electric Company had licensed the Westinghouse Company under patents having to do with incandescent lamps. The terms of the agreement allowed General Electric Company to specify the prices at which the lamps might be sold. The Attorney General of the United States entered suit against General Electric, contending that such a provision was illegal under the antitrust laws. The Supreme Court decided against the government, holding that the license gave Westinghouse no title in the patent so that if the monopoly granted by the patent was to be adequately maintained the patent owner (General Electric) must be allowed to fix the prices at which the product might be sold.

The owner of a patent may assign it to another and convey, (1) the exclusive right to make, use and vend the invention throughout the United States, or, (2) an undivided part or share of that exclusive right, or (3) the exclusive right under the patent within and through a specific part of the United States. But any assignment or transfer short of one of these is a license, giving the licensee no title in the patent and no right to sue at law in his own name for an infringement. . . . Conveying less than title to the patent, or part of it, the patentee may grant a license to make, use and vend articles under the specifications of his patent for any royalty or upon any condition the performance of which is reasonably within the reward which the patentee by the grant of the patent is entitled to secure. It is well settled, as already said, that where a patentee makes the patented article and sells it, he can exercise no future control over what the purchaser may wish to do with the article after his purchase. It has passed beyond the scope of the patentee's rights. . . . But the question is a different one which arises when we consider what a patentee who grants a license to one to make and vend the patented article may do in limiting the licensee in the exercise of the right to sell. The patentee may make and grant a license to another to make and use the patented articles, but withhold his right to sell them. The licensee in such a case

acquires an interest in the articles made. He owns the material of them and may use them. But if he sells them he infringes the right of the patentee, and may be held for damages and enjoined. If the patentee goes further, and licenses the selling of the articles, may he limit the selling by limiting the method of sale and the price? We think he may do so, provided the conditions of sale are normally and reasonably adapted to secure pecuniary reward for the patentee's monopoly.[20]

Indeed, as already said, price fixing is usually the essence of that which secures proper reward to the patentee.[21]

The conclusion is that price fixing is legal under a genuine licensing arrangement in which the licensee is granted the privilege of making and selling an article or device protected by a patent. The patent owner-licensor is not only privileged to stipulate a royalty as high as he chooses, but also the number of patented articles which the licensee will be permitted to manufacture, where he may sell them, and the price he may charge. But if the agreement between the patent owner and the licensee is such as to establish the licensee as a party having an ownership interest in the patent, the licensor loses all legal control over articles manufactured in conformity with the agreement.

On the point of permissible controls over a licensee, the General Electric case has been cited in a considerable number of subsequent cases. The reasoning of the court has not been discarded, but numerous distinctions have been drawn between the particular set of facts in the General Electric case and those in the subsequent cases. The conclusion might be justified that the General Electric Company was represented by especially capable attorneys who were able to present successfully their client's case to the court.

There are other controls that the patentee may exercise

[20] *Ibid.*, pp. 489–90.
[21] *Ibid.*, p. 493.

which flow directly from the patent monopoly. The patentee remains within his granted powers when he parcels out licenses on a territorial basis, thereby establishing a number of submonopolies operating within a territory designated by him. "If the territorial assignee sold outside his territory, presumably no right to use the device under the patent would pass. . . ." [22] The owner of the patent may restrict the place at which the licensee may work the patent,[23] thereby making the task of determining the output much less difficult, and eliminating a cause for misunderstanding between the parties. Likewise, the courts have recognized the right of the patentee to grant a license effective for a limited time and no longer, even though the license expires before the patent runs out.[24]

A patentee is within his legal rights in prescribing the style, quality, or other features of the product when licensing another to manufacture and sell his patented article.[25]

It is altogether reasonable, under such circumstances, that the conditions and methods of manufacture should be within the patentee's control. He has a direct interest that the reputation for serviceableness of his patented article should not be impaired, and therefore that its manufacture should be uniform and the finished product in accord with his design. Until manufacture is complete and the dominion of the licensor has been relinquished, the article has not passed beyond the domain of the patent monopoly—it has not entered the field of trade, wherein the principle of competition resumes its normal sway.[26]

[22] "The Scope of the Patent Monopoly: Control of Supplies and Accessories and Restrictions on Use," *Harvard Law Review*, Vol. LII (December, 1938), p. 317. See also, H. A. Toulmin, Jr., "Patent Pools and Cross Licenses," *Virginia Law Review*, Vol. XXII (December, 1935), p. 135.

[23] *Pope Manufacturing Co.* v. *Owsley*, 27 Fed. 100 (C.C. Ill. 1886).

[24] *Mitchell* v. *Hawley*, 83 U.S. 544 (1872).

[25] *Westinghouse Co.* v. *Fibre Co.*, 268 Fed. 121 (1920).

[26] National Industrial Conference Board, *Trade Associations* (New York: National Industrial Conference Board, 1925), pp. 134–35.

Another restriction upon the licensee that the patent owner has been allowed to exercise is the limitation of the use of the patented invention to specified purposes.[27] Provisions of this sort were found in the license agreements under which the various glass container manufacturers used Hartford-Empire Company's patented machinery. Those agreements also stipulated the maximum output that could be made on the patented machines,[28] which is a proper use of the patent monopoly.[29] Furthermore, there appears to be no conflict with the antitrust laws when restrictions are placed upon the licensee's methods of marketing, or if he is limited to a particular class of vendees.[30] Provisions of the latter type were found in some of the Hartford-Empire license agreements,[31] and also in the license agreement allowing the Corning Glass Works to utilize the General Electric Company's patent on inside frosted bulbs. The bulbs could be sold only to specified manufacturers of incandescent lamps.[32]

When the patentee leases patented machines to manufacturers who have been licensed to use the machines, the law is not so clearly defined. Presumably, the patent owner can require that all repair parts for the machinery be purchased from him. This requirement should not have to be explicitly stated if the owner of the patent is alert. He should be so efficient that the licensee would logically look to him to supply the repair parts. Such restrictions cannot be justified, economically, if this is not true.

[27] *Rubber Co.* v. *Goodyear*, 76 U.S. 788 (1869).

[28] TNEC 2, pp. 401 ff.

[29] *Goshen Rubber Works* v. *Single Tube Auto and Bicycle Tire Co.*, 166 Fed. 431 (C.C.A. 7th, 1908).

[30] *Radio-Craft Co., Inc., et al.*, v. *Westinghouse Electric and Manufacturing Co.*, 7 F. (2d) 432 (C.C.A. 3d, 1925).

[31] TNEC 2, p. 406.

[32] *Ibid.*, pp. 646–47.

Practices prohibited by the antitrust laws. As noted above, there is but one bit of declaratory law pertaining to the definition of the patentee's monopoly power. This is found in Section Three of the Clayton Act, which reads in part as follows:

> That it shall be unlawful for any person . . . to lease or make a sale or contract for sale of goods, wares, merchandise, machinery, supplies or other commodities, whether patented or unpatented . . . or fix a price charged therefor, or discount from, or rebate upon, such price, on the condition, agreement or understanding that the lessee or purchaser thereof shall not use or deal in the goods, wares, merchandise, machinery, supplies or other commodities of a competitor or competitors of the lessor or seller, where the effect of such lease, sale, or contract for sale or such condition, agreement or understanding may be to substantially lessen competition or tend to create a monopoly in any line of commerce.

This section was specifically designed to overcome an abuse that had become quite prevalent—the use of "tying agreements" to force licensees to use unpatented supplies and accessories if they used any of the licensor's patents. These cases comprise the first of two main classes of cases in which the Supreme Court has been called upon to decide whether the exercise of rights claimed to exist by virtue of a patent has been so extended as to make the parties liable for their acts under the rules of the general law, of which the Sherman and Clayton Acts are a part. The second class of cases involves the right to fix the price of articles manufactured under a patent.

The courts were tending to limit the use of tying agreements somewhat independently of express Congressional action.[33] It is now quite definitely established that a patentee cannot lawfully require a licensee or purchaser of his pat-

[33] National Industrial Conference Board, *op. cit.*, p. 133.

ented device to use prescribed materials or machines in conjunction with the patented device.[34] "The patent right confers no privilege to make contracts in themselves illegal, and certainly not to make those directly violative of valid statutes of the United States." [35]

It has been held a violation of the antitrust laws to impose restrictive covenants which tend unduly to restrict competition beyond the scope of the patent monopoly, whether in the form of license agreements or otherwise. The reasoning of the court can be followed in the case of *Radio Corporation of America* v. *Lord*.[36] The Radio Corporation of American held patents on the TRF set or circuit, and licensed manufacturers to use the patented circuits. It was stipulated in the license agreement that the licensees were to purchase from RCA the exact number of tubes required for originally equipping the sets manufactured under the patent. There appeared to be obvious reasons for requiring that the licensees purchase the tubes from RCA. First, RCA wanted the licensed sets equipped with good tubes. Secondly, the best tubes required the use of patents controlled by RCA, which patents could not be used by others without infringement. Finally, RCA wanted to profit from the tube business. It could earn a very good profit from this business because of the techniques that had been developed in its plants. To make sure of this profit it only needed an assured outlet for the tubes.

[34] *Motion Picture Patents Co.* v. *Universal Film Manufacturing Co.*, 243 U.S. 502 (1917) and *U.S.* v. *United Shoe Machinery Co.*, 258 U.S. 451 (1922). In these cases the former rule, as established in *Heaton-Peninsular Button Fastener Co.* v. *Eureka Specialty Co.*, 77 Fed. 288 (1896), and applied in *Henry* v. *A. B. Dick Co.*, 224 U.S. 1 (1912), both of which were decided before passage of the Clayton Act, was overruled.

[35] *U.S.* v. *United Shoe Machinery Co.*, 258 U.S. 463 (1922).

[36] *RCA* v. *Lord*, 28 F. (2d) 257 (C.C.A. 3d, 1928). Writ of certiorari denied, 278 U.S. 648 (1928).

Competing tube manufacturers brought suit against RCA. They contended that the license agreement amounted to a contract for the sale of tubes with the condition that the purchaser should not deal in the tubes of a competitor, and therefore violated the Clayton Act. The court asked itself three questions in reaching a decision. First, was there a sale of goods? Second, was the sale made on the condition that the purchaser should not deal in the goods of a competitor? Third, did the agreement have a tendency to "substantially lessen competition" or to "create a monopoly in any line of commerce"? In answer to the first two questions the court found that there was an agreement to buy and sell radio tubes, and that by agreeing to buy enough tubes to install in all the sets manufactured under the license the licensee in effect agreed not to buy tubes from any other manufacturer for that purpose.

The most important part of the decision appears to be found in the answer to the third question: did the agreement tend to lessen competition or create a monopoly? In answering this question it was pointed out that the licensees, taken together, did at least 70 per cent of the business in radio sets. Unlicensed tube manufacturers were excluded from this market, so far as original installation was concerned. Furthermore, the licensees would tend to supply for replacements, and the public would tend to buy for that purpose, the same brand of tubes as were original equipment in the sets. There was, consequently, a substantial lessening of competition. The fact that RCA need not have licensed any manufacturers, but could have retained the sole right to make and sell the TRF sets, and hence the tubes that went into them, made no difference to the court. It was decided that RCA had overstepped the bounds of the power granted to it under the patent.

Strong arguments in justification of tying agreements can be cited. One argument has already been stated in the above discussion of the Radio case. The successful operation of some patented devices requires the best quality of supplies and accessories, which the patentee could supply, but not exclusively, for they are not covered by patents. In order to assure satisfactory results to the user and to preserve for himself such commercial value as arises from the satisfactory operation of his device, it is held that the patentee should be allowed to require that the machine be used only with specified supplies, accessories, and complementary equipment. The argument is also advanced that in the case of many patented machines there is no convenient method of assessing royalty for their use. In such cases it is held that, if the patentee were allowed to establish himself as the exclusive source of supply for the materials used in the operation of the machine, he would have an accurate, inexpensive, and convenient measure of the output under the patent. He would also have a handy means of collecting the royalty for such use of the patent by charging extra for the supplies sold to the licensee. "Under such an arrangement, the money burden upon the licensee does not fall upon him all at one time, like the necessity of paying at the outset a large purchase price, but is distributed over a period sufficient to enable him to derive, from the use of the patented article, the means of compensating the patent owner." [37]

The courts, and the Congress, have felt that the weight of experience and reason have been more than sufficient to counterbalance the above arguments. Their aim has been to maintain competition and to prevent the growth of monopoly beyond the bounds established by the patent statute and the claims of the patent grant.

[37] Gilbert H. Montague, "The Supreme Court on Patents," *Yale Law Journal*, Vol. XXI (May, 1912), p. 595.

It is manifest that if the use of other articles or devices, patented or unpatented, were to be permitted to be "tied" to the use of the patented machine or process, the way would be opened to an undue restriction of competition in branches of trade not encompassed by the legal monopoly established through the patent law.[38]

The second general class of cases that the courts have been called to pass upon involves the right of the patentee to exercise control over the prices charged for the patented good. Essentially, this was the situation in *Bauer* v. *O'Donnell*,[39] in which it was held a violation of the Sherman Act to incorporate in the contract of sale the price at which the patented preparation could be sold at retail. In this case the patentee was marketing a patented drug preparation. It was stated on the carton that the product was licensed "for sale and use at a price not less than one dollar." The product was distributed through regular jobber channels, from which it was purchased by the retailer. Neither the retailer, O'Donnell, nor the jobber were agents or licensees of the patentee, Bauer. In its decision, the Supreme Court said that "The right to vend conferred by the patent law has been exercised [in the sale to the jobber], and the added restriction is beyond the protection and purpose of the act. This being so, the case is brought within that line of cases in which this court from the beginning has held that a patentee who has parted with a patented machine by passing title to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act." [40] Thus the attempt to control resale is prohibited on the ground that, when the patentee has parted with property in an article manufactured under his patent, he cannot thereafter exercise control over it.

[38] National Industrial Conference Board, *op. cit.*, p. 133
[39] 229 U.S. 1 (1913).
[40] *Ibid.*, p. 17.

The use of patents to support a price-fixing monopoly was the issue in the recent Ethyl Gasoline case.[41] In this case the Supreme Court unanimously condemned the use the corporation had made of its patents. The Ethyl Corporation manufactured a patented fluid to be added to gasoline to increase the efficiency of high compression engines. This fluid was sold to gasoline refiners. All but one of the 124 leading refiners had accepted licenses to process their gas with the Ethyl fluid. The corporation required that all the jobbers who wished to handle the treated gas also take a license. To secure and retain these licenses, jobbers had to adhere to a "code of ethics," and the court found that adherence to this code meant the maintenance of prices and the following of price policies set by the major oil companies. The scene depicted by the record "is one in which appellant has established the marketing of the patented fuel in vast amounts on a nation-wide scale through the 11,000 jobbers and at the same time (by the leverage of licensing contracts resting on the fulcrum of its patents) it has built up a combination capable of use and actually used as a means of controlling jobbers' prices and suppressing competition among them."

This case is an illustration of a patent monopoly illegally enlarged for the exploitation or promotion of a business not embraced within the patent. The Ethyl Corporation neither owned nor sold the patented fuel, nor derived any profit through royalties from its sale. It chose to exploit its patents solely through the manufacture of the fluid covered by them and to sell that fluid to refiners for use in the manufacture of motor fuel. The licensing conditions were not used as a means of stimulating the commercial development and financial returns of the patented invention, but for the commercial development of the refiners' interest.

[41] *U.S.* v. *Ethyl Gasoline Corp., et al.*, 309 U.S. 436 (1940).

But patent property is like any other kind of property; it must not be used as an excuse or cover for the violation of other laws, such as the laws against monopolies. Patents cannot be used as a subterfuge for an agreement amongst manufacturers to restrain trade beyond the necessity of protecting the interests granted by the patents.[42]

[42] Toulmin, "Patent Pools and Cross Licenses," p. 123.

CHAPTER VI

PATENT MONOPOLY AND THE ANTITRUST LAWS

[*Continued*]

Use of patents to circumvent the antitrust laws. There are many issues along the boundary between the patent and antitrust laws that have never been brought to trial. Until they are judicially determined, borderline practices are likely to be resorted to whenever the expected results warrant the risk of prosecution by the Antitrust Division of the Department of Justice. The traditional procedure of the Antitrust Division is the case by case method, which enables it to take up problems industry by industry, and situation by situation, but results in a very limited number of prosecutions.

The continued existence of these borderline practices is not due to the failure of the antitrust laws—rather, they have gone by default.

As the present assistant attorney general, Thurman Arnold, has pointed out, the great trust-busting campaign of Theodore Roosevelt was conducted with 7 lawyers and 4 stenographers. In 1933 the Antitrust Division had a professional staff of only 26. When Mr. Arnold took office in March, 1938, this staff numbered 59. Even today, there are in the Antitrust Division only 190 lawyers and 17 experts. During most of the Antitrust Division's history, one or two major cases have been more than sufficient to absorb the entire time of the personnel, and today it would be easy to use the whole staff in the prosecution of re-

straints upon housing alone. Indeed, 27 per cent of it is being so used. The simple fact has been that until recently no broad effort could be made to enforce the law for lack of people to do the work. Even now the staff is less than a fourth of that found necessary to administer the securities acts and about one seventh of that which administers the Interstate Commerce Act.[1]

The antitrust laws are necessarily phrased in general terms which are subject to determination by the courts in respect to any given set of facts. It would be practically an impossibility to try to legislate on every prevailing practice, and every possible practice, although the Clayton Act did specifically declare tying agreements to be illegal. Where other practices prevail, their legality must be determined by the judiciary. Such a situation has resulted in the growth of a number of practices which may be illegal, but which persist pending suit by the government to ascertain their exact status.

When these activities are carried on in conjunction with the monopoly obtained under a patent there is, on the face of things, reason to believe that the patent owner's program falls within the sphere of activities protected by the patent grant. When the law enforcement agencies instigate antimonopoly suits, they quite naturally and properly seek out those practices which will make the best cases for presentation to the court. They tend to stay clear of cases where the issue is questionable, unless the practice is flagrantly against the public interest. To do otherwise would make the antitrust laws even less effective than they are today, for every decision against the government would lessen the deterring effect of the law upon the activities of businessmen. It is therefore reasonable to presume that, unless the public inter-

[1] Corwin D. Edwards, "Can the Antitrust Laws Preserve Competition?" *American Economic Review Supplement*, Vol. XXX (March, 1940), pp. 166–67.

est is flagrantly abused, the government's antitrust suits will be entered against such unmistakable violations as are almost certain to result, in the minds of the men responsible, in verdicts favorable to the government. The Antitrust Division has undoubtedly hesitated to proceed against questionable practices where patents are involved, for the patent monopoly is not sharply defined.

In the light of such a situation it could be expected that practices would develop in conjunction with the use of patents that might not be socially justifiable, and which might exceed the powers granted by the patent. Such practices have been designated as "unfair competition." [2] Some of them might also be labeled as "unfair monopoly," for they are practices that are based upon the *presumed* monopoly power granted by the patent. As illustrative of such practices, the following will be considered: forced validity, litigation, and the prolonging of the patent monopoly.

Some contracts granting a licensee the right to work a patent contain a provision that the licensee will not contest the validity of the patents he is licensed to use. Part of the consideration for the license is the agreement not to question the patent. This is referred to as "forced validity." Practices of this sort were recently found in the glass container industry. The Hartford-Empire Company licensed glass container manufacturers to operate under its patents, specifying in the license agreement that "So long as this license remains in force, the licensee agrees not to dispute the validity of the Letters Patent under which this license is granted. . . ." [3]

In this particular case the patent owner was, for all practical purposes, protected from being sued on the validity of

[2] Floyd L. Vaughan, *Economics of Our Patent System* (New York: Macmillan, 1925), p. 105.

[3] TNEC 2, p. 453.

his patents, for Hartford-Empire licensees produced 97 per cent of all the glass containers made in the United States. None of its licensees could question the validity of its patents and remain licensees. Any question that might arise from the other small producers, who manufactured but 3 per cent of the total output of containers, would likely be of relatively minor importance to a firm of the size and resources of the Hartford-Empire Company.

This provision in the Hartford-Empire license agreement led to an interesting situation in 1934. The Amsler-Morton Company of Pittsburgh, an engineering firm, was in the business of supplying glass annealing equipment to manufacturers, in competition with Hartford-Empire. Several efforts had been made by Hartford-Empire and its representatives to obtain control of the Amsler-Morton Company. When they were unsuccessful, Hartford-Empire tried to dispose of this competitor by other means. One of the Amsler-Morton customers, the Swindell Company, of Baltimore, which A-M was obligated to defend by contract, was sued by H-E for patent infringement. A-M wanted to enter a countersuit against H-E, for A-M believed they held the dominant patent themselves. A-M was prevented from doing so, however, for the Swindell Company was licensed to use some H-E equipment. In the license was the above-mentioned provision that the licensee would not question the validity of the licensors' patents. Consequently, the validity of the H-E patents could not be questioned before the courts. It was forced, in this instance, not only upon the licensee, but also upon a third party having a contractual relationship with the licensee.[4]

The above-mentioned case is not only an example of the forced validity of patents, but also illustrates how litigation

[4] *Ibid.*, pp. 599-600. Testimony of Paul L. Geer.

can be used as a weapon of unfair competition. By entering suit against the Swindell Company, H-E hoped to ruin a competitor who could not be reached in any other way. It thereby hoped to further strengthen its own monopoly position. The more complete the monopoly that H-E could secure, the more freedom would it have in determining the quantity of goods to be produced and the prices at which they would be sold.

This follows from the very nature of monopoly. When competition and monopoly are considered side by side, they appear as thesis and antithesis. Competition operates to keep prices related to costs, whereas the *sine qua non* of monopoly —its very purpose—is to break the connection between cost and price and to allow the monopolist, whether he be a single individual or several firms in tacit or explicit agreement, to pitch the scale of his operations at that level which will maximize his net profits.[5]

The businessman, whether he is in a monopolistic or competitive industry, is not directly concerned with the satisfaction of the wants of society, as such. He is only concerned with maximizing his own net profit. If the industry is one that operates under competitive conditions, the economic welfare of society and the economic welfare of the individual businessman are both realized, for the businessman makes the greatest profit by expanding his output until marginal cost and marginal revenue are equal. Under competition, the marginal revenue and average revenue (demand) curves for the firm are both horizontal (BP in Chart A), so that price and cost are equal. This is not true if the industry is monopolized. The economic welfare of society and of the monopolist are incompatible. Because of the slope of the demand curve, the intersection of the marginal revenue and marginal

[5] See the discussion of monopoly price at the end of this chapter.

cost curves is much to the left of where it would be under competitive conditions. This means that the quantity produced is less and the price asked is greater under monopoly than under competition. When the monopolist maximizes his net profits, goods sell at higher prices and society's wants are not provided for as adequately. "One may posit the thesis that the economic interests of society rest upon the maximum satisfaction of human wants at the least cost. To secure this result efficient units of organization must be preserved and inefficient units destroyed. Methods of competition which prevent the realization of these two objects are economically unfair." [6] Unfair competition puts a limitation upon the satisfaction of human wants and results in an unduly high price for what is made available. Any practice that promotes monopoly is, then, justly called unfair competition.

Litigation can be a weapon of unfair competition in other ways than that illustrated above by the Amsler-Morton case, where suit was brought against the customer of the party to be put at a disadvantage. It may be brought directly against the intended victim. In some cases the mere threat of litigation may suffice to accomplish the hoped-for result.

Any sort of litigation is costly. Court processes are slow and expensive, and suits involving patents and their validity are especially costly. Patent law is a specialized branch of the law, practiced by a limited number of highly trained attorneys. Patent suits usually require much testimony by professionally trained engineers, accountants, and market analysts. The transcripts of testimony and the briefs of the arguments run to great length. All of these items make the proceeding extremely expensive.

The Ford Motor Company has found patent litigation to

[6] Vaughan, *Economics of Our Patent System*, p. 105.

be a definite expense from year to year. General Motors Corporation spent $2,526,010 in the defense of 99 patent suits during a recent 15-year period. In 1937 its patent litigation costs amounted to more than $260,000.[7] A group of independent glass companies incurred an expense of between $130,000 and $140,000 in defending a patent dispute with the Hartford-Empire Company. In the 12 years from 1926 to 1938 the Obear-Nester Glass Company, an independent producer, spent $200,000 on patent litigation, having had to defend suits over the entire period. The Hazel-Atlas Glass Company, through a subsidiary, was involved in litigation with H-E over a period of five years, the defense of which cost from $50,000 to $150,000 per year.[8]

Such nonproductive expenses make serious inroads upon the revenues of the litigants. If the defending company is going to be able to remain in business over a period of years, its revenues must be sufficient to cover its total expenses. This means that the price of the product must be higher than the actual cost of production by enough to cover the litigation expense. Litigation, then, unduly raises the price of the product, and keeps the product beyond the reach of a portion of society which otherwise would use it.

Established manufacturing companies are often called upon to defend a patent infringement case that the plaintiff bases on a "paper patent," that is, a patent that has never been worked. Approximately 95 per cent of the suits brought against the Ford Motor Company are suits in which the holder of the patent is not engaged in manufacturing, and in a very large majority of the cases he has never been engaged in manufacture.[9] The Packard Motor Car Company has had

[7] TNEC 2, pp. 277, 335, and 365.
[8] *Ibid.*, pp. 537, 585, 629, and 631.
[9] *Ibid.*, p. 260. Testimony of I. Joseph Farley.

similar experience.[10] This has led some persons to the conclusion that paper patents are used for the purpose of litigation and threatened litigation, thereby harassing active manufacturers. But paper patents have a use other than this. "As a matter of fact, many inventions start from paper patents and are followed by the practical application of the invention. It comes on later and other patents are granted on the improvements." [11] It is unlikely, however, that very many such patents which are used as the basis for suit are the subject of much subsequent development. They usually cover quite trivial inventions.

The expenses of litigation can sometimes be eliminated by cross-licensing the patents involved. When cause for suit develops, the parties get together and agree to let each other use their individual patents rather than suffer the expense of litigation. If the plaintiff has a particularly strong case, the defendant may be willing to pay something to procure such a license agreement. So far as any individual case is concerned, it is to the defendant's advantage to do this if he can get the license for anything less than the expected cost of the litigation.

Numerous examples of cross-licensing that have eliminated prospective litigation can be cited. The Illinois Glass Company and the Hartford-Empire Company entered into a cross-licensing agreement in 1924, thereby adjusting a situation that promised lengthy and expensive court proceedings.[12] Three manufacturers of talking dolls found that their patents were overlapping, and rather than enter upon expensive court processes they cross-licensed each other and devoted their whole efforts to manufacturing, thus doing a

[10] *Ibid.*, p. 327. Testimony of Milton Tibbets.
[11] *Ibid.*
[12] *Ibid.*, p. 496. Testimony of Lloyd T. Williams.

better job of manufacturing and foregoing the expense of the litigation.[13] The same device was utilized by the aviation industry to overcome a complicated patent situation.[14]

The prospect of extensive patent litigation has been a factor to be reckoned with in the establishment of a business based on a new invention. Prior to 1934 there was no way to determine if the new patent would infringe upon patents held by others, except to start working it and await suits for infringement. At that time the courts would decide the issue. This difficulty was partially met by the passage of the Declaratory Judgment Act of 1934.[15] It is now possible for a patent owner to test the validity of his patent upon his own initiative, without waiting for someone to proceed against him. There have been a number of recent cases where this right has been availed of, and it can be expected that the procedure will be used even more as the statute becomes better understood by the attorneys who practice patent law.

A third practice which might be considered as unfair competition is that of prolonging the patent monopoly beyond its normal life of seventeen years. This can be done in various ways. One way is to take out patents for improvements upon the basic invention. Improvement patents granted subsequent to the basic patent remain in force after the basic patent expires, thus continuing the patentee's control over a field of activity.

It often happens that if minor improvements are protected by patents, machines and processes licensed under the original basic patents are given a much longer earning life by the fact that the minor improvements continue the protection on the machines, and even when the basic patents expire, others are

[13] H. R. 4523, pp. 632–33. Testimony of Louis V. Aronson.
[14] *Ibid.*, pp. 775 ff. Testimony of Frank H. Russell.
[15] 48 Stat. 955 (1934); 28 U.S.C.A. 400.

prevented from using the latest commercial form of the machine.[16]

"Fencing-in" is another practice that increases the monopoly that a basic patent confers. The practice here is to take out patents on alternative items in order to protect the basic idea. Patents are often taken out on something that is not considered as good as the main invention in order to keep outsiders from breaking into the main patent.[17] Patents may also be taken out on improvements of a competitor's device so as to prevent his device from reaching an improved stage.[18]

While it is true that this process aids in the expansion of the original idea, it most certainly results in a contraction of productive facilities and of lowering costs until it soon contracts production itself. The claim is made that "fencing-in" is indulged in from a protective point of view, to protect those inventions and patents and machines presently in use, but this is not borne out by the evidence which indicates a desire to withhold improvements until a return has been obtained on the old and now "obsolete" machinery. One method suggested for dealing with "fencing-in" is to treat it as an unfair trade practice, the evil being not in inventing and patenting *per se*, but in its use or non-use for the purpose of hurting a competitor.[19]

The great industrial companies that maintain their own research laboratories take out many patents on devices collateral to their own line of development. In this way they "fence-in" their own particular field and "fence-out" competition. It is alleged that these patents are also the basis for threatened infringement suits and for scaring away competi-

[16] TNEC 2, p. 777. Memo from the files of the Hartford-Empire Company.

[17] H. R. 9259, p. 144. Testimony of T. F. Bailey.

[18] TNEC 2, p. 776. Memo from the files of the Hartford-Empire Company.

[19] Forkosch, *op. cit.*, p. 194.

tion. This use has resulted in such patents being called "shot-gun" and "scare-crow" patents.

> The great research laboratories are only incidentally technological centers. From the business standpoint they are patent factories: they manufacture the raw material of monopoly. Their product often is nothing but a "shot-gun," a basis for threatening infringement suit and scaring off competitors; or a "scare-crow," a patent which itself represents little or no contribution but seems, at least *prima facie*, to cover an important part of a developing art and hence permits threat of suit.[20]

Trade-marks are also used to enhance a patentee's monopoly. Trade-marks may be registered with the United States Patent Office for a period of 20 years, at the expiration of which they may be renewed for a like period. Although many business ventures owe their origin to invention, their continued existence is often dependent upon public good will. "This good will is built-up reputation, the link between the manufacturer and the public. Its symbol is the trade-mark by which the public identifies the product." [21] If the trade-mark is obtained before the patent is issued, it exists independent of the life of the patent—that is, it can be extended to a total of 40 years. However, if a trade-mark is registered for an already patented article, the trade-mark monopoly and the patent monopoly expire together.[22] It is possible to maintain a monopoly for a period of 40 years rather than for but 17 years by registering the trade-mark before the patent is issued. While this is not the same monopoly as the patent monopoly, it achieves similar results for the monopolist for a considerably extended period.[23]

[20] Kahn, *op. cit.*, p. 485.
[21] Wright, *op. cit.*, p. 139.
[22] *Ibid.*, p. 137.
[23] Monopolies based on trade-marks turn upon product differentiation. Those based on patents may be derived from greater efficiency and lower

There is still another way of extending the monopoly period granted by a patent. It can be done by prolonging the time that the application remains in the Patent Office before issue, thereby allowing the market for the invention to develop before it is brought out into the open. A patent application can be kept in the Patent Office by means of interference proceedings between applications owned by the same interests.[24] This, fortunately, is a rare, but nonetheless obnoxious, abuse of the interference practice. There are more subtle ways of prolonging the time that an application remains in the Patent Office. Those most often resorted to are the holding up of correspondence just as long as the law allows, the revision of applications, and the use of divisional applications.[25] By holding the application in the Patent Office it is possible to employ the "drag-net" technique.

Beyond the "shot-gun" and "scare-crow" techniques, there is a third monopolistic method: the "drag-net," whereby corporations and individuals keep alive at the patent office great numbers of applications covering all potential developments in the field, revise those applications to cover any new competitive devices subsequently developed, and then take out the patents as their own and sue to protect them. The "drag-net" is also a means of involving competitive patent applications in the long and costly interference proceedings of the patent office. Hence many individuals and corporations seek as a matter of course to keep applications pending as long as possible.[26]

It is often possible for a monopoly that was established on the basis of patents to maintain its monopoly position even

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costs of production, enabling the patentee to capture the market by selling at lower prices, as well as from product differentiation.

[24] See *Thompson Spot Welder Co.* v. *Ford Motor Co.*, 268 Fed. 836 (1920).

[25] Laws enacted in 1939 were designed to expedite the passage of a patent application through the Patent Office.

[26] Kahn, *op. cit.*, p. 485.

after all its patents have expired. The monopoly of the Aluminum Company of America was originally based on the patented Hall process of electrolytic refining, which has long since expired without greatly affecting the company's monopoly position. The patent on heat resistant glass, sold under the name "Pyrex," expired in 1936, but the Corning Glass Works still dominates the field, its only competitor being the McKee Glass Company, formerly licensed by Corning. The present monopoly appears to be based on the "know-how" or technique of manufacture, taken together with the rather large investment required to enter upon production.[27] In these cases patents are not the basis for the present monopoly position. The monopoly exists independently of any patent, although the protection of the original patent enabled the companies involved to get such a start that ordinary competition now holds no fear for them.

Discussion. The direction in which business practices have been moving in recent years raises a basic question in respect to the type of control that the government should resort to in order to assure the best possible utilization of the human and natural resources of the country and the most equitable distribution of the resulting product. On one hand there is the traditional antitrust policy of attempting to stamp out monopoly and maintain competition, which is conceived to be more or less self-regulatory.[28] On the other hand is the recognition of the inevitability of combinations and the resultant monopoly (in many fields, at least), with the policy of regulating monopolies and large

[27] TNEC 2, pp. 648, 652, and 656. Testimony of Amory Haughton.

It might be noted that the prices for "Pyrex" ware were substantially reduced at about the time the patents expired. This undoubtedly helps to explain why the Corning Glass Works has been able to maintain its dominant position.

[28] TNEC 2, p. 255. Statement by Thurman Arnold.

scale undertakings in such a way as to achieve the desired results.[29]

The Federal Trade Commission and the New Dealers on the Monopoly Committee alike speak for the small bourgeoisie. If their "lines" conflict head-on it is the clash of a new orientation with one that is outworn. The F. T. C. is fighting, doggedly but with little imagination, a rear-guard action. Its fight against monopoly was lost when America emerged from the World War the most powerful monopoly-capitalist state in the world. The New Dealers, more brilliant and sophisticated, are aware of the nature of the post-War changes in American capitalism and of its ever-increasing drive toward monopoly and financial concentration. They understand it is futile to oppose this tide with the antiquated weapons of "trust-busting"—weapons which even before the War were pitiably ineffective. Therefore, they say, let us recognize that our economic system is incurably monopolistic and try to control monopolies through the state.[30]

This latter approach was that of the NRA, which recognized, approved, and encouraged combinations, but sought to prevent such combinations from becoming the tools of unscrupulous individualists by imposing regulations as to maximum hours and minimum wages. Governmental control over prices was not included, with the result that many of the expected benefits were dissipated in price increases. The wage and hour laws that have been placed on the statute books since the NRA was declared unconstitutional attest to the continued belief of the New Dealers that the automatic economic forces are insufficient to achieve the desired ends. It is a well-known fact that many of them believe

[29] See A. A. Berle, Jr., "Monopoly Report to the TNEC," *Printers' Ink*, Vol. CLXXXIV (September 1, 1938), pp. 15–17 and 67–81.

[30] Dwight MacDonald, "The Monopoly Committee: A Study in Frustration," *American Scholar*, Vol. VIII (Summer, 1939), pp. 306–307.

that the economy of the future will be one of regulated monopolies, rather than composed of many small competing units which would be self-regulatory. At the present time the representatives of the government in Washington are divided in their approach to the problem, for the Antitrust Division of the Department of Justice and the Federal Trade Commission, the two enforcing agencies, are strong advocates of the policy of eliminating monopolies and enforcing competition. Their approach to the problem is through more vigorous enforcement of the antitrust laws. The determination of the Antitrust Division, revitalized under the hand of Thurman Arnold, Assistant Attorney General, is evidenced by the increasing number of prosecutions entered upon by the government.

The recent drive by the Antitrust Division has not been directed *around* the hazy area that exists along the boundary between the patent laws and the antitrust laws, but has been aimed right at the *center* of the disputed territory. Two cases have already been concluded to the pleasure of the government. One is the Ethyl Gasoline case, cited above. The other ended in a consent decree which it was hoped would break up the monopolistic conditions found to prevail in the glass container industry by the Temporary National Economic Committee Investigation of the Concentration of Economic Power.

These cases again raise the question as to how far a patentee may carry his monopoly without coming into conflict with the antitrust laws. The answer is that he must stay within the scope of his exclusive franchise to be protected in an action for restraint of trade. When he steps outside of it, his conduct is tested as though he had no patent. The patentee's monopoly within his field is complete. If he at-

tempts to go beyond it, he is without the protection of his patent. To determine whether he is within the limits of his monopoly, regard is had to the grant in the patent statute and to the specifications and claims of the patent.

Frequently reference is made to a so-called conflict between the Sherman Act and the patent law. Such expressions indicate a failure to appreciate that the legal rights under the patent statute constitute a valid exception to the prohibitions of the Sherman Act, to the same extent that letters-patent for new inventions were excepted in the ancient Statute of Monopolies. In the debates in the Senate on the Sherman Act, it was said by Senator Sherman: "It is the unlawful combination, tested by the rules of common law and human experience, that is aimed at by this bill, and not the lawful and useful combination. . . . *A limited monopoly, secured by a patent right is an admitted exception.* For this is the only way by which the inventor can be paid for his invention." (21 Cong. Rec., Part 3, 2457. Italics are the writer's.) [31]

The patentee is allowed perfect freedom from prosecution under the antitrust laws so long as he stays within the limits of the monopoly granted to him. He is allowed to do with his patented product or process whatever he wishes. He may manufacture in great or small quantities, or not at all. He may exploit his monopoly to the fullest extent in pursuit of that reward which the Constitution provides for the inventor who so orders his activities as "to promote the progress of science and useful arts." This, however, is as far as he can go. As soon as he oversteps the boundaries of his own private monopoly, he comes into conflict with the antitrust laws, designed to preserve competition, and thereby to secure for society the benefits expected to be derived therefrom.

[31] Lamb, *op. cit.*, p. 266.

Monopoly Price

The actions of the monopolist who owes his monopoly position to a patent grant are further restricted by forces far different from the antitrust laws. The antitrust laws prevent him from extending his monopoly beyond his particular patent grant. These other forces, however, tend to dictate his actions even within the confines of his own legally sanctioned monopoly area. Reference is had to the elasticity of demand, lack of information, regard for future demand, and potential competition.

Because of diminishing utility, the limited purchasing power of consumers, and the availability of substitutes, greater quantities of a good will normally be purchased at low prices than at high prices. This is referred to as the elasticity of demand. On the basis of the relation between the rate of change in quantity taken and the rate of change in price as between any two points on a demand curve, it is possible to distinguish between different degrees of elasticity. If the rate of change in quantity taken exactly equals the rate of change in price, it is said that the elasticity of the demand curve is equal to unity. If the rate of increase in quantity taken is greater than the rate of decrease in price, the demand curve is referred to as being *elastic*. If the rate of increase in quantity taken is less than the rate of decrease in price, it is said to be inelastic.

Confronted with a given cost situation, would the monopolist prefer his monopolized good to have an elastic or an inelastic demand curve? If his average total cost per unit were constant, his net profits could be maximized under a perfectly elastic demand curve, assuming that the demand curve lay above the average cost curve. The difference be-

tween price (which would always be the same) and cost would be a constant amount regardless of the output, and so the profit per unit would always be the same. The monopolist could expand output to infinity and make an infinite profit. If he were faced with increasing average total cost with expansion of output, he would prefer a monopoly over some good the demand for which was inelastic. By offering a smaller quantity for sale he could get an increasingly higher price and increase his total revenue. By contracting the quantity manufactured he could reduce his total costs. Under such circumstances the monopoly profit would be achieved by a minimum output. If the monopolized good could be produced at a decreasing average cost, the monopolist would prefer that the demand for the product be elastic, and the more elastic the better. This is true because price would fall less than proportionately to the increased quantity sold, while cost per unit decreases as output is increased. By expanding his output indefinitely, assuming that increasing cost does not set in, the monopolist could maximize his net profit, at the same time selling always at lower and lower prices.

If the monopolist is not fully acquainted with the shape and location of the demand curve for his product (and he likely is not), he is at a loss as to the quantity of goods to produce and offer for sale to maximize his net profits. He might be well advised as to his costs of production, but unless he had considerable knowledge of his demand curve, he could not use his knowledge of costs to the fullest advantage.

Furthermore, the monopolist must have regard for future demand by not setting his monopoly price so high as to alienate consumers while maximizing his profits in the short run. Once having spent a great deal of money on a monopoly product, people may not have enough to spend that much

again; or having learned their lesson, they may purposely keep away from the product and get out of the habit of buying it. Thus it pays a monopolist to exercise a degree of moderation in his price policy for the sake of future business.

It should also be noted that few patent monopolists are free to determine the price of their product in accordance with their own unrestricted wishes. This is because of the pressure of substitutes. A patented article is often simply a superior device for doing what was previously accomplished in some other way. Too grasping a price policy may lead people to return to the former device. The availability of substitutes and the prices at which such substitutes can be purchased tend to limit the price that the monopolist can charge for his article.

Reference is here made to direct substitutes. For example, there are numerous alternative materials that might be substituted one for another in the construction of a house, such as wood, stucco, and brick. If the price of one were unduly high, the others would be used to a greater extent. But there is another type of substitution that bears on the problem. It might be termed indirect substitution. If building costs were so high that home-ownership entailed an unduly great sacrifice, people might decide to buy new automobiles rather than to build or purchase homes.

This case is a bit different from that of direct substitution, for it is an entirely different want that is gratified by the substitute good. When wood is substituted for brick in the construction of a house, the finished product still satisfies the desire for housing; but when a new automobile is substituted for a house, it is an entirely different desire that is satisfied. This latter substitution is resorted to in order to balance the sacrifice entailed in the marginal expenditure with the utility obtained by the marginal purchase. The

sacrifice required for the purchase of a high-priced house would outweigh the satisfaction to be derived from owning it, while the sacrifice necessitated to obtain the automobile would be more than offset by the utility flowing from its use and ownership.

A final point should be noted. Few monopolies, even if based on patents, are impregnable. Frequently, such monopolies are maintained only because of a reasonable price policy. It has already been noted that substitutes may be resorted to if the monopolist's price policy is unreasonable. But, furthermore, high prices and large monopoly profits create a monetary incentive for greater inventive activity. Efforts will be made to "circum-invent" the patent situation in order to participate in the profits that are apparent to inventors and directors of industrial research laboratories. The importance of the pecuniary motive in determining the amount and direction of inventive activity has already been developed.[32] If it appears that the patent monopolist is exploiting a particularly lucrative field, an effort is likely to be made to develop an alternative product in order to take advantage of the prevailing high prices and prospective profits. The result would be two, or more, competing monopolists, each competing against the other in a market that is founded on a single want. To thwart the development of such potential competition, the patent monopolist must necessarily adopt a reasonable price policy, being content with a lower return over a longer period rather than immediately endeavoring to squeeze "every last bit" of profit from his patent.

[32] See Chapter II.

CHAPTER VII

PATENTS AND MONOPOLISTIC COMPETITION

MANY people believe that a patent gives the inventor an absolute monopoly. They believe that the owner of a patent is free to exploit his monopoly to the fullest extent without serious repercussions. This is, of course, incorrect. No monopoly is absolute. Every monopolist has to consider the demand for his monopolized product; the pressure of substitutes, both direct and indirect; potential competition; the possibility of alienating future demand; and the possibility of intervention by the government. Every monopoly, whether it is based upon a patent or some other condition, is limited by these factors. Monopolies based upon patents are even further limited.

Monopolistic competition. A new analytical technique has recently been made available to economists by Professor Edward Chamberlin.[1] This new technique recognizes that both monopolistic and competitive forces combine in the determination of most prices. The result is a hybrid theory which affords a more illuminating approach to the study of the price system. The monopolistic competition analysis is peculiarly applicable to the situations that are created by

[1] Chamberlin, *The Theory of Monopolistic Competition,* Ch. V. Anyone unfamiliar with the theory of monopolistic competition can profitably refer to Professor Chamberlin's book at this point.

the existence of patent monopolies in an economy otherwise conceived to be competitive.

The usual price analysis has assumed the condition of perfect competition or perfect monopoly. The analysis for competitive price has been based on (1) a standardized product and (2) a large number of buyers and sellers. If a standardized product is being offered for sale, the only element that causes a buyer to prefer one seller to another is a lower price. It is a matter of indifference to buyers which seller they purchase from so long as the price is the same. Because the goods are perfectly homogeneous, buyers can substitute with complete satisfaction the product of one seller for that of any other seller.

Competitive analysis also assumes a large number of sellers. The amount of the product offered for sale by one seller is then so small a part of the total supply that any change in the amount which he sells has no appreciable effect upon the price. When this is true, the individual seller produces on the assumption that his entire output can be disposed of at the prevailing price. Prices are equated to costs, profits tend toward a minimum, and output is maintained at a high level.

Perfect monopoly is the antithesis of perfect competition. Monopoly means control over supply: the total supply offered on the market is controlled by a single interest. Control over the supply makes it possible for the monopolist to control the price (within the limits imposed by the demand for his product) at which his product is sold. Monopoly price is therefore higher than competitive price, monopoly profit is greater than competitive profit, and monopoly output is less than competitive output.

Very few monopolies are absolute; but monopoly elements are found in many market situations. Likewise, there

are very few perfectly competitive markets. In many cases the number of sellers is quite limited, and the product sold in many "markets" is not homogeneous. "Homogeneous competition" gives way to "heterogeneous competition." Neither the theory of perfect competition nor the theory of perfect monopoly adequately explains the conditions under which many prices are determined. Herein lies the superiority of the monopolistic competition analysis.

The theory of monopolistic competition takes into consideration the effects of business practices that are resorted to for the purpose of distinguishing competing products from one another. Product differentiation tends to reduce the elasticity of substitution between goods—that is, if "the good" is slightly different from competing "goods" it can be sold in a "market" more or less set apart from the general market for that type of good. To this end distinctive packages are adopted for salt, sugar, and other products. China and glassware are packed with oatmeal. Evaporated milk is "irradiated." Peanut butter is "homogenized." Cigarette tobaccos are "toasted." Automobiles are equipped with "electro-matic" or "vacu-matic" shifting devices—or no gear shift at all. These distinctive features are added to the product to set it apart—to differentiate it—from the product of competitors. To the extent that differentiation is successful, the producer has a temporary market set apart from the general market for oatmeal, evaporated milk, cigarettes, or automobiles.

The producer of a differentiated product has limited monopoly power over his own particular portion of the general market. Because the "products" being offered on the "market" are not all alike, differences in prices can exist without all buyers flocking to purchase the lowest priced good. A Packard may sell for less than a Buick, but the

Buick has a "Fire-ball" engine for which some people are willing to pay a little more. Both are automobiles; but because of product differentiation Buick can exercise some degree of independence in its marketing policies.

There is a limit to Buick's independence, however, and this limit is determined by the ease with which a Packard can be substituted for a Buick. Manufacturers of goods that have many close substitutes cannot charge for their goods much above the prevailing level of prices without suffering a serious loss of sales. They have very little independence. They have very little monopoly power. The manufacturers of "Lucky Strike" cigarettes have apparently found that other brands of cigarettes are such close substitutes that "Luckies" must be sold at the prevailing price for cigarettes. The "toasting" process does not sufficiently differentiate "Luckies" to set them apart from the general market for cigarettes. On the other hand, if there are no close substitutes for the good, the manufacturer can set his price more or less independently of the prices charged for "competing products." When the Schick electric razor was first introduced, the nearest substitute was the safety razor. There was a wide spread between the prices of the electric razor and the safety razor. This condition clearly demonstrated the monopoly elements adhering to the sale of electric razors.

There are two factors of prime importance in considering monopolistic competition. The first has been introduced above. It is elasticity of substitution—that is, the ease with which one good can be substituted for another. Easy substitution of one differentiated good for another reduces the monopoly elements adhering to each. The purpose behind differentiation is to make the product so distinctive that there are no satisfactory substitutes—that is, to limit competition. The amount of competition tends to be de-

termined in any given case by the ease of substitution. The principle of substitution must be recognized in an adequate explanation of the price system.[2]

Freedom of entry is the second factor that is important when considering monopolistic competition. Freedom of entry refers to the possibility of new firms entering the general field. New firms are attracted by an apparent prospect for profits. This prospect need not be exploited by producing an identical good, as would be true under pure competition. The new firm can compete by producing a substitute good.[3]

The freedom with which the producers of substitute goods can enter into competition affects the profitableness of an undertaking. Higher profits prevail if there are restrictions upon the entry of competitors. There are numerous barriers that may keep out new competitors, but the existence of patents is the only one considered here. New undertakings may not be launched because of the possibility of litigation with a firm already in the field and known to control a large number of patents. Basic patents with broad claims may prevent any direct substitutes from

[2] The usual price analysis has neglected the elasticity of direct substitution by assuming (contrary to actual conditions) the homogeneity of all competing goods. Indirect substitution has been recognized, however, in the usual demand curve, which shows the quantities that will be purchased at the various prices. This takes cognizance of the fact that every good has to compete with every other good for the consumer's dollars. The thousand dollars spent for a new automobile might have been the down-payment on a new house. Although housing and transportation are not direct substitutes, one for the other, they do compete for the consumer's dollars.

[3] Neither is it necessary that the market for the new product be built up at the expense of the firm whose profits attracted the new undertaking. Thus the markets for latecomers manufacturing electric razors were partially built up at the expense of the Schick shaver, partially at the expense of safety razors and safety razor blades, and partially at the expense of barbers.

being produced. In every case, patents prevent newcomers from manufacturing and selling an identical product.

Restrictions upon the entrance of competing firms and competing products tend to result in prices above competitive prices. If the number of monopolistic competitors is relatively small, each may recognize the effects that his own price cutting would have upon other sellers. Each may, therefore, adopt a policy of "live and let live." There is no effective price competition. The absence of price competition and the restriction of free entry into the field tend to cause the prevailing prices to remain above competitive prices, and the competing monopolists tend to obtain profits above the normal rate.

The general theory of monopolistic competition explains the conditions brought about by the existence of patent monopolies. Patented features are used to differentiate a product and set the market for it apart from the general market. Because patents restrict free entry into the "industry," the number of producers is small. Because of the relatively small number of "competitors"—that is, competing patent monopolists producing substitute goods—each cognizant of the full effects of any move he might make, the prevailing price tends to be higher than the competitive price. Because the patent situation prevents potential competitors from entering the field, profits tend to be above the normal level.

It is necessary to recognize elements of monopoly and of competition in order to arrive at any valid conclusions when considering the effect of patents upon an industry. Each patent grant creates a monopoly, but several such patent monopolies may compete one against the other. Patents are sometimes said to create competition.[4] This is indeed

[4] H. R. 9259, p. 84. Statement by Milton Laurent.

possible, for a patent holds promise of sufficient protection to enable a new firm to establish itself without being unduly harassed by competitors. But the fact that others are prevented from competing (in large numbers, at least) brings into focus the existence of monopolistic competition, that is, a group of competing monopolists. Because of this hybrid development it appears advisable to use the analytical techniques applicable to monopolistic competition, rather than those applicable to either pure monopoly or pure competition. The theory of monopolistic competition encompasses both monopoly and competition, but is sufficiently flexible to allow greater emphasis to be placed upon one or the other, depending upon the particular situation. In respect to the effects of patents, it is found that the monopoly elements are dominant but do not exclude the competitive elements, and so the techniques of the monopolistic competition analysis are peculiarly applicable.

Basic patents. A patent on a basic invention tends to give the patentee an immediate and absolute monopoly. If the claims are sufficiently broad, the monopoly is protected from encroachment by other products that are direct substitutes—that is, the patented product is the only one that satisfies a given want. This does not mean that the monopolized product is without competition, however, for every good is in competition with many other goods for the consumer's dollar, indirectly if not directly. Not only do Fords compete with Plymouths, but mink coats compete with automobiles.

If the basic patent were let out on an exclusive license arrangement, the licensee would stand in the same position as the patentee. He would have an absolute monopoly, so far as competition from direct substitutes were concerned. But if the basic patent were to be developed under a plurality

of licenses—that is, if more than one firm, but still a limited number, were licensed under the patent—monopolistic competition would exist. The greater the number of licensees the greater would be the likelihood that the marketing of the product would break down into pure competition. If an open license plan were followed, all comers being granted licenses, competition would tend to prevail. If the open license system were resorted to only after the passage of some time, following a period during which but a limited number of licenses had been granted, one would expect that there would be monopolistic competition merging into pure competition. It is unlikely that perfect competition would ever be achieved, however, because of the "custom" that would become attached to particular firms during the period of their semi-exclusive licenses.

A situation similar to that just considered is observable in the glass container industry. The Hartford-Empire Company obtained basic patents covering automatic machinery used in the manufacture of glass containers. Hartford-Empire licensed a limited number of manufacturers to use its patented machinery. Of the total output of glass containers in the United States, 96.6 per cent was manufactured by the H-E licensees and affiliates. Outsiders were kept from competing by a rigorous program of infringement suits. Within the group of licensees, H-E maintained control by various means, such as allowing only certain companies to make specified types of ware, limiting the quantity that might be produced, limiting the territory in which a licensee might sell his product, and just plain moral suasion. In addition, a system of price leadership prevailed in respect to some items, although it would be difficult to prove that there was any specific agreement as to prices.[5] In fact, no

[5] See TNEC 2, pp. 383, 404–405, 415, 547–48, 563–67, 585, 588, 597–99, 613–15, 619–24, and 791 for verification of these statements.

specific agreement was necessary, for there were so few firms making any one type of ware that each could easily appraise itself beforehand of both the direct and indirect effects of any price changes that it might initiate. Once the best price for the industry was determined, there was no incentive for varying from it, so long as demand and cost conditions did not change too much. Actually, price changes were seldom made.

The monopolistic practices prevailing in the glass container industry prompted the government to begin an anti-trust suit against the parties involved. The suit was withdrawn by the government when a compromise consent decree was worked out. By the terms of the decree, the patented machinery will be made available to all who want to manufacture glass containers. In effect, the decree provides for a wide-open licensing system. It is hoped that a considerable number of new firms will enter the field, and that competition will replace monopolistic competition. If this is the result, it is doubtful if the transition will be completed for some time, for the already established firms have attracted to themselves a certain clientele during the period of their semi-exclusive licenses. They have established marketing connections and the reputation for a quality product which it will be difficult for newcomers to overcome except with the passage of a considerable period of time.

Only a few of the many patents issued cover basic inventions. It is therefore almost impossible to establish such a tight monopoly as prevailed in the glass container industry, which was built on basic patents. In most fields there is a limited number of competing monopolists, the number being limited by the possibility of obtaining patents on substitute products.

Product patents. Fairly perfect substitutes are developed

and patents obtained for them unless a patent monopoly rests upon a basic invention. The original product, over which the patentee has a monopoly, is then faced with competition from these subsequently developed products, which are also monopolized. Even though each patentee has an absolute monopoly over the sale of his own particular product, the several different monopolized products must compete for custom in the same general market, for the several "products" satisfy but a single consumer desire. The market situation is one of competing monopolists.

If it were possible for different inventors to obtain patents on a large number of substitute products, the market situation might eventually become competitive. This condition would not be reached, of course, until there were so many products and so many different producers supplying the market based upon the given desire that the withdrawal of any one of them would have no appreciable effect upon the quantity of products, or the amount of utility, being offered for sale. Another way of defining this competitive situation would be to state that it would exist only when there were so many producers endeavoring to satisfy the given demand that no one of them considered either his direct or indirect influence upon price. When the competing monopolists consider neither their direct nor indirect influence upon price, the competitive price tends to prevail, regardless of numbers.

If sellers were to recognize their *total* influence upon price—that is, the direct effect of their own actions plus the indirect effects which result from the actions forced upon competitors by the policy being pursued by any one of them—the monopoly price would prevail.[6] Sellers would be more likely to recognize the total influence of their

[6] Chamberlin, *The Theory of Monopolistic Competition*, p. 54.

actions upon the price if their number were relatively small. This is the situation most likely to prevail among competing patent monopolists, because of the obstacles to be surmounted in entering the field.

There are but a limited number of possible products that will satisfy any given desire. If one or more of the products are patented, it is more difficult to obtain a patent upon a third product. As more and more patents are granted upon substitute products designed to satisfy a given want, it becomes progressively more difficult to establish before the Patent Office the novelty necessary to obtain a patent on a competing product. The very fact that it would be a competing product establishes a prima facie case against the existence of any great degree of novelty. If one fails to obtain a patent on an additional alternative product, because of lack of novelty or conflict with the claims of an already issued patent, he is merely inviting a suit for infringement if he undertakes to manufacture. For these reasons, in fields where patents exist at all, there are but a limited number of firms competing to satisfy the demand for a given utility. The market situation is one in which there are but a limited number of sellers. This brings both the direct and indirect effects of any proposed changes in marketing practice into sharp focus. The prevailing price tends to be a monopoly price—or at least a price somewhat above the competitive price.

So far, it has been implicitly assumed that each competing patent monopolist owns but one patent which bears directly upon his own particular product. If one or more of the monopolists held a plurality of patents, it could be expected that the number of competitors would be further reduced. If patents were taken out on every possible substitute device, potential competition would be eliminated.

If patents were taken out to cover improvements of a competitor's device, that competitor would be precluded from keeping up with developments and would gradually be squeezed out.[7] The result would be a smaller number of competitors, further assuring the conditions of monopolistic competition.

It should be recognized that in many cases products can be considerably differentiated and still be competitive. That is, within limited price ranges consumers will substitute one product for another more or less willingly. The demand for "the good" in such a situation is hardly to be shown graphically by a single line. Rather, it should be represented as an area, taking the general shape of the usual demand curve, but having breadth as well as length. "The price" of "the good" then refers to a price cluster, rather than to a single price. This follows from the fact that a single homogeneous market does not exist. Rather, there is a separate (though related) "market" for each "product," but each "market" is to be found within a limited portion of the "demand area," and the prices form a cluster within that portion.

Process patents. The United States Patent Office grants patents on processes of manufacture, as well as upon products. For example, the Hall electrolytic process of refining aluminum was patented. The flotation process of refining mineral ores has been patented. The Steenbock process of adding vitamin D to evaporated milk is patented. To the extent that the patented process is the only feasible method of producing a given good, it provides the patentee with an absolute monopoly, subject to the qualifications already noted. If there are several different processes for obtaining

[7] Such has been the avowed policy of the Hartford-Empire Company in respect to machinery for the automatic production of glass containers. It held a great many patents. TNEC 2, pp. 771 ff. Memo on policy of Hartford-Empire Company. See especially p. 776.

a given result, all patented, the conditions of monopolistic competition are established, for the existence of the patent situation precludes unrestricted entry to the field. With but a limited number of competitors in the field, it becomes possible for the firm to foresee not only the direct effects of its own actions, but also the indirect effects—the reactions of competitors to the changed situation. Consequently, the price that will tend to prevail is the monopoly price, for each firm is in a position to realize that it is a monopoly price which will increase its own returns.

When the only feasible method of producing a given good is patented, the owner of the patent may work it himself or license others to work it. If he works it himself, or grants an exclusive license for its use, the situation is one of monopoly. If, however, he grants a limited number of nonexclusive licenses, a condition of monopolistic competition prevails, with results similar to those when a limited number of nonexclusive licenses are granted under a product patent. An illustration can be cited.

In 1925 Professor Harry Steenbock, of the University of Wisconsin, received a patent for the irradiation process of adding vitamin D to evaporated milk and other products. The patent was assigned to the Wisconsin Alumni Research Foundation for exploitation. Five or six of the largest companies were licensed to use the process. Since then, evaporated milk that has been enriched with vitamin D by the irradiation process has enjoyed a distinct advantage in the sale to consumers. Unless it is sold at a higher price, other brands do not sell in their usual volume. The licensed companies control from 60 to 65 per cent of the nation's evaporated milk, and there seems to be little doubt that the granting of but a limited number of licenses will "enhance concentration in that industry." "The granting to these

few companies of exclusive rights to the use of the irradiation process has lent great strength, in the form of additional product differentiation, where strength is least needed and probably, from a social point of view, already excessive." [8]

The granting of a limited number of licenses under the Steenbock patent served to restrict the number of firms competing for the particular market, and the differentiation of the product set that market apart from the general market for untreated evaporated milk. Among the licensees, the conditions of monopolistic competition prevail. The licensees compete against each other, but the number competing is so small that each can readily recognize both the direct and the indirect effects of any price cutting on his part. The prevailing price tends to be the monopoly price, except as other factors bear upon the situation.

There is some justification for granting an exclusive license or a limited number of licenses, under a patent, whether it is a product patent or a process patent. If but a limited number of licenses are granted, it is easier for the patent owner to exercise control over the exploitation of the invention. Granting but a limited number of licenses also facilitates the determination and collection of such royalty as is agreed upon. The most often cited reason for granting but a limited number of licenses is that such a program is the only one that will assure commercial development of the invention. This is the usual argument against compulsory licensing. It is alleged that the prospect of a speculative profit is sufficiently certain only if there is to be a monopoly, or near monopoly. If open licensing were resorted to, competition would be so severe as to preclude the possibility of earnings sufficient to amortize the developmental costs, and

[8] William H. Nicholls, "Some Economic Aspects of University Patents," *Journal of Farm Economics*, Vol. XXI (May, 1939), p. 497.

businessmen could not be attracted to the proposition. This is one of the important reasons cited to justify the entire patent system. When used as a justification for granting a limited number of licenses, it is open to criticism.

> The most common argument given in support of a limited number of exclusive licenses is the necessity of assuring the commercial development of the patent. This argument assumes that (1) the firms in the given industry are small and financially weak (. . . It is interesting to note that this argument is similar to the familiar "infant industries" justification of a tariff . . .); and (2) free competition exists to protect the producer and consumer. When these conditions are not met—and they usually are not in old, well-established industries, where control is concentrated—limiting the number of licenses to the few dominant firms may not be socially desirable.[9]

Patent monopolies are granted to inventors as an incentive to inventive activity and to assure the exploitation of new inventions by giving the businessman an opportunity to develop the invention without being harassed by competitors. Patent monopolies exist as an exception to the general condemnation of monopolies and are justified on the ground that they "promote the progress of science and useful arts." But it does not follow that these ends are furthered when the patentee licenses a limited number of firms to exploit the patent, as in the evaporated milk case. In that particular case, the granting of the licenses to the larger firms served to increase such advantages as they already experienced, and introduced monopoly conditions into a situation which had previously been more or less competitive. Such results might be generally expected. If it were possible for the leaders in an industry to secure licenses under all patents that pertained to their fields, there would be little inducement for them to develop new ideas of their own accord.

[9] *Ibid.*, pp. 497–98.

Fewer competing inventions would be made. As for the exploitation of the licenses, there would not be such a strong incentive to achieve maximum efficiency. The licensees, bound together in a common undertaking through the license, tend to have a feeling of fraternity with their "competitors." A condition of "live and let live" is likely to prevail.

The type of market competition that exists is determined largely by the type of patents that dominate an industry. If several firms are licensed to manufacture under a process patent, it is presumed that they make a homogeneous product which will be sold in a single market. Where there is a single market, *ceteris paribus*, a single price will prevail. Once the equilibrium price is established, whether it is the monopoly price or the competitive price, further changes would be disadvantageous to everyone. This would also tend to be true when there are several different processes of making any given product. To the extent that the different processes impart slightly different characteristics to the finished product, however, the market situation approaches that which would normally exist if there were a limited number of differentiated but substitute products being manufactured under product patents.

When the demand for a given "good" is satisfied by several slightly differentiated products, the distinctive features of which are denied competitors because of the existence of product patents, a single homogeneous market does not exist. Rather, there are a number of slightly different but closely related markets. When such a market situation prevails, the seller has some degree of independence in determining his marketing policy.

Where there are a limited number of competing firms serving the market, as tends to be true under either process

or product patents, the prevailing price will tend to approach a monopoly price. Any lower price would yield lower returns to the monopolistic competitors, whose numbers are so few that each can fairly readily ascertain both the direct and indirect effects of any changes initiated by himself.

Patents, efficiency, and monopolistic competition. So far, the effect of patents as an element conducive to monopolistic competition has been considered from two angles. Patents, especially product patents, result in product differentiation, thereby creating a number of smaller interrelated markets in place of one large homogeneous market. This makes it possible for the "competitors" to act with some degree of independence in respect to their own market. Furthermore, the existence of patents limits the entrance of competitors and therefore the number of competitors in the field. The result is that the few competing firms can more or less readily ascertain the probable effects of any moves away from the status quo that are initiated by themselves. Here are two monopoly elements flowing from the operation of the patent system. A third monopoly element is found in those efficiency-promoting inventions that can be exploited by only a limited number of firms because of the patent situation.

Over a period of time, if one (or a few) manufacturers are able to produce at a lower per unit cost of production, and thereby to sell at a lower price, it can be expected that they will make most of the sales. If the lower cost is achieved by the utilization of patented processes, machines, or devices, from the use of which competitors are excluded, the bankruptcy of the competitors and the subsequent domination of the market by the efficient firm can be expected. If there is but a single survivor, the result is monopoly. It is more likely, however, that there will be more than one survivor,

for alternative efficiency-promoting inventions are stimulated as price competition becomes more intense; [10] but developments in this direction are limited by the difficulty of obtaining patents. The conditions of monopolistic competition come to prevail as the number of competitors in the field becomes smaller.

It need not necessarily hold that efficiency-promoting or cost-reducing developments will lead directly to monopolistic competition. The same result can be achieved by utilizing the savings to improve the quality of the product, thereby differentiating it from competing products and establishing a more or less private, though related, market in which it is sold.

> . . . when products are differentiated, buyers are given a basis for preference, and will therefore be paired with sellers, not in random fashion (as under pure competition), but according to these preferences. Under pure competition, the market of each seller is perfectly merged with those of his rivals; now it is to be recognized that each is in some measure isolated, so that the whole is not a single large market of many sellers, but a network of related markets, one for each seller.[11]

Under these conditions it may be possible for the firm to adjust its "product" so as to increase its net returns. Here it is assumed that the price is one generally prevalent, one established by tradition or trade practice, or one determined upon by an earlier decision and to which the customers have become habituated. Changes in the product alter the demand for it and also the cost of producing it. The adjustment involves selecting the "product" whose cost and whose market will achieve the largest total profit, price being given.

Discussion. The reason why the monopolistic competition

[10] Plant, *op. cit.*, p. 36.

[11] Chamberlin, *The Theory of Monopolistic Competition*, p. 69.

approach is preferred when one is dealing with the conditions brought about by the existence of patents turns upon the shape of the demand curve for the output of an individual firm. It is the shape of the demand curve that marks the contrast between monopolistic and perfect competition. Under perfect competition the conditions within the industry are such as to make the demand curve for the output of an individual firm perfectly elastic, that is, horizontal. Under monopolistic competition, either because of product differentiation or the fact that the output of any one firm is a significant portion of the total, the demand curve is tipped from the horizontal.

The fact that patents restrict entry into a field does not of itself set that field apart as being characterized by monopolistic competition. Restriction of entry into an industry is quite compatible with pure competition, provided only that the conditions within the industry are such as to make the demand curve for the output of any individual firm perfectly elastic.[12] Under monopolistic competition there can be freedom of entry, but owing to product differentiation this freedom exists only in the sense of a freedom to produce substitutes. In this sense it might be said that freedom of entry is universal, since substitutes are a matter of degree.[13]

Patents, however, do restrict the entrance of new firms that propose to produce *near* substitutes, thereby setting apart a monopoly area that can be exploited by the small number of patentees who are actually competing, one against another. In such a case patents limit the number of competitors and allow the demand curves of the indi-

[12] See Joan Robinson, "What is Perfect Competition?" *Quarterly Journal of Economics*, Vol. XLIX (November, 1934), pp. 104–11.

[13] See Edward Chamberlin, "Monopolistic or Imperfect Competition," *Quarterly Journal of Economics*, Vol. LI (August, 1937), p. 567.

vidual firms to remain farther to the right than they otherwise would. That is, each firm has a greater individual market, and the circumstances are favorable for the patentees to take monopoly profits. The patent situation may, however, lead to larger scale operations and a greater degree of specialization by the firms in the industry, thereby resulting in economies, and possibly lower prices, if the gains are not offset by monopoly profits.[14] But, because of monopolistic competition—because of the competition of near substitutes —patent monopolies may not be a vehicle for obtaining the large profits usually expected from a monopoly. One reason for this is that the market for the "good" has to be shared with substitutes. Another reason is to be found in the assumption that the sellers make in regard to the effect that their actions will have upon competing monopolists. Furthermore, in some cases what would appear to be monopolistic exploitation turns out to be a symptom of greater precision in the satisfaction of consumers' wants.[15] Buyers are given a greater variety from which to choose, and are thereby better able to find the exact good to satisfy their desire. This service can be provided only at a cost, which cost eats up part or all of the higher prices charged for the goods.

Subject to the benefits mentioned, there are certain definite evils that tend to characterize all monopolies, whether they be the absolute monopoly of a single seller or the many-headed creature that thrives within the patent system. In order to obtain all the profits possible, the monopolist must charge a price somewhat higher than the competitive price.

[14] See Joan Robinson, *The Economics of Imperfect Competition* (London: Macmillan, 1933), p. 340.

[15] See Donald H. Wallace, "Monopolistic Competition and Public Policy," *American Economic Review Supplement*, Vol. XXVI (March, 1936), pp. 77–94.

This higher price does not reflect a greater desirability of the good, nor does it recompense the monopolist for any cost he has incurred. All it does is to transfer purchasing power from the pocket of the consumer to that of the monopolist. Monopoly price effects a redistribution of purchasing power to the advantage of the monopolist.

In order to make the monopoly price effective, it is necessary to restrict the quantity that is offered for sale. This means that the sum total of consumable goods is less in an economy dominated by monopolies, as compared with an economy characterized by competition. The true end of production is the means to consumption and "consumption is the consummation of the economic process." The results desired of the economic system cannot be achieved if monopolists restrict the output of goods in order to augment their own pecuniary returns.

A further difficulty follows from the monopolist's restriction of output. The demand for the agents of production is affected. There is a smaller demand for capital goods. There is a smaller demand for land. And especially important, there is a smaller demand for labor. If monopolies exist, the scale of operations will be less than it would be in a competitive economy. If the industrial mechanism operates at fractional capacity there is less employment and a lower standard of living all around.

These are evils of partial monopolies no less than of absolute monopolies. When they exist on a small scale, the effects may not be as noticeable, nor the results as grave, but they are to be no less severely condemned.

CHAPTER VIII

EXPLOITATION OF PATENTED INVENTIONS

THREE general means of exploiting a patent are available to the inventor: he may sell the patent outright, he may license others to operate under the patent, or he may work the patent himself. In any case, the value of the patent must be determined as a basis for subsequent action.

Valuation of patents. Any consideration of the value to be placed upon patents must recognize that there are two problems involved, rather than just one. It is an entirely different problem to arrive at the value of a patented invention that has been put into use than to determine the value of one that is not already being exploited. In the former, there is some experience upon which to base the appraisal. In the latter, the evaluation must be made without the advantage of known results to check against. There are, however, some things to keep in mind which help in appraising an unexploited patent.

Some classes of patents tend to have a very limited value. Patents on methods or processes used in manufacturing are more or less easily infringed without any redress for the patentee because of the difficulty of proving the infringement. This is so because the process is ordinarily utilized on the infringer's own property, which may be kept fairly secret from public observation. An exception to this would be a

case where the patented process is the only commercially feasible method available. The Hall electrolytic process for refining aluminum is an example.[1]

Patents on specialized machinery and equipment used in production may likewise have but limited value: (1) because they are so easily infringed in secrecy; (2) because their field of application is so limited; and (3) because alternative means of accomplishing the same ends are so readily devised. The relative ease of devising alternative equipment for the common machines of commerce, such as gas engines, steam shovels, lathes and concrete mixers, limits the value of any specific development in such lines.[2]

Patents for improvements on devices already patented are also of limited value. This is true because such improvements are subservient to the earlier and broader patents. The owner of an "improvement" patent may be unable to dispose of his patent to the owner of the basic patent for more than a nominal sum. Furthermore, he cannot exploit his idea himself without permission or awaiting the expiration of the senior patent.

Another class of patents having but limited value are those procured on designs. Such patents go no further than protecting the patentee's exact design. They do not prevent others from making and selling something that is essentially the same, having merely a different appearance.

A final group of patents that are of relatively small value are those which have not been tested in the courts. There is doubt about the strength of the monopoly that a patent confers until court adjudication of its validity. Although the Patent Office makes a search of the prior art, there is no

[1] George Hart Morse, *The Valuation of Patents* (Washington, D.C.: The Author, 1933), p. 6.

[2] *Ibid.*

presumption that every possibility has been investigated. Actually, many invalid patents are issued. The only means of determining whether or not a particular patent does carry with it sufficient unattackable monopoly power to make it really valuable is to have it tested by litigation.[3] Prior to 1934 the patentee had to assume a passive role until he was actually sued for infringement, for he had no means of obtaining access to the court before being sued. This was changed with the passage of the Declaratory Judgment Act in 1934.[4]

There are some types of patents that are immediately discernible as being valuable. One has already been mentioned—a patented process covering the only feasible method of accomplishing a desired result, such as the Hall process for refining aluminum. Patents of a basic nature on machines that enable cheap and rapid production in large quantities may be very valuable, especially when patents for alternative methods and for improvements are held by the same patentee.[5]

The patents for some compositions of matter may be valuable if they are of a basic nature. In most instances, however, similar results can be achieved by some alternative composition, thereby decreasing the value of the original formula.

The great bulk of patented inventions come under the designation of "manufactures." Some of these may be quite valuable. The commercial value of any such patent must be individually determined on the basis of the probable cost of production and marketing, and the available markets,

[3] Von Gehr, *op. cit.*, p. 397.

[4] See Chapter VI.

[5] See the testimony concerning the glass container industry in TNEC 2, pp. 377 ff.

both potential and active. It might be said, of course, that the value of any patent rests upon this same basis.

Some of the business reasons that make a given patent desirable or valuable to a certain person are set forth below, and a patent may be held for any of the following reasons:

Demonstrated or potential earning capacity.

To keep better devices off of the market so that an original line may continue to be exploited without costly improvement and without competition.

To control a field of development so as to discourage others from entering the same general line or interfering through alleged infringements. . . .

To establish reputation and good will, the advantages of which may persist long after the patents upon which they were built have expired.[6]

Patents are property, albeit intangible and fragile property,[7] and can be valued in the same way as other property. Once the patent is being exploited, it may be possible to determine the amount of profits therefrom, or the savings effected, or the losses eliminated. Capitalizing that figure gives a value for the patent. In the case of an unexploited patent, presuming it to be valid, it may be possible to arrive at an estimate of the profit, or saving. By capitalizing the estimate, one arrives at an estimated value for the patent.[8]

Several factors must be held in mind in capitalizing the estimated earnings. One is the rate of return to be used. The rate of return should reflect the degree of risk involved, which in turn is dependent on several conditions. The rate should be high if it is probable that the new invention will be rendered obsolete by subsequent developments. The rate

[6] Morse, *op. cit.*, pp. 9–10.

[7] TNEC 3, p. 978. Testimony of Dr. Frank B. Jewett.

[8] H. A. Toulmin, Jr., "Ask Borrowers About Patents," *Bankers Monthly*, Vol. XLIX (August, 1932), p. 485.

should likewise be high if the new invention will have to compete with a number of similar but noninfringing devices already established in the market. Possible infringement litigation is also a risk to be considered.

Every possible factor that may affect the exploitation of the invention should be considered, but should be considered only once. If the estimate of profits has been arrived at in the light of certain factors, those factors should not be considered again when deciding upon the rate at which to capitalize the earnings. It is probably the policy of wisdom to adopt a conservative course, however, rather than to overlook items that might detract from the value of the patent.

In capitalizing the estimated earnings, one must keep in mind that the life of a patent is but seventeen years. The only income that is certain to accrue directly because of the patent will have to obtain during that period. It is not amiss to point out, however, that it is possible to build up reputation and good will during the period of the patent monopoly. This is a sort of "scrap value" that adheres to some patents and which may persist long after the patent has expired. This is an incalculable value in most cases, particularly at the time the patent is issued. Consequently, it can have little effect upon the value of the patent at that time. Furthermore, such "scrap value" is so often due to the business efforts of the exploiter, through advertising outlays for example, that it may be unwise to give it any particular consideration.

It should be noted that during the normal life of a patent there are two opposing forces at work that affect the value of the patent. They are *appreciation* and *depreciation.* During the first few years of its life the yearly income from the working of a patent should increase as the "product" be-

comes better known and as the "kinks" of production are eliminated. How long this force will prevail may be open to question, but there is little doubt that it does exist.[9] The value of a patent would appreciate considerably upon favorable completion of litigation in the courts. This result could be achieved only after several years of the patent monopoly had elapsed. It is likely that this would be reflected in a new and more favorable rate of capitalization, although it is conceivable that the earnings of the patent might thereby be enhanced. An unfavorable court decision, of course, would have the opposite effect, but it need not deprive the patent of all value.

In some cases patents may be expected to depreciate in value during their life.[10] This would be especially true of patents on novelty items and patents on improvements of basic inventions. Novelty items lose their novelty after a few years of exploitation, and improvements are superseded by new improvements, so that the income to be derived from such patents can be expected to decline as they grow older.

In calculating the possible earnings of a business based upon one or more patents, it should be held in mind that capital must be employed which could be used in other ways. The entire earnings cannot be attributed to the monopoly coexistent with the patent. Part of the earnings flow from the capital that is used. This is a true opportunity cost which must be recognized in the calculation of the prospective profits that are to be capitalized. This consideration is of especial note if the inventor undertakes to exploit his patent himself. He must also recognize his own labor or managerial

[9] Morse, *op. cit.*, p. 14, considers it of importance for the first four years of the life of a patent.

[10] Wright, *op. cit.*, p. 97.

activities expended in the undertaking, and make due allowance for his imputed wages.

One further point is worthy of consideration in arriving at the value of a patent. This is that a patent may be a liability —a cost item rather than an income item. This condition follows from the fact that patents, as they issue from the Patent Office, are not presumed to be valid. Their validity cannot be fully established except after thorough testing in the courts. Such court proceedings are extremely expensive. Consequently, the net financial returns from the patent may be negative. In that case, of course, the patent would be valueless—indeed its value would be negative.

Exploitation of a patent by the patentee. Having arrived at an estimate of the value of his invention, the inventor is in a position to decide whether to exploit his patent himself, or to make other arrangements. Assuming that it is possible for the inventor to enter upon the exploitation of his invention, it is possible, if the undertaking is successful, that his returns will be greater than the royalties he could obtain by licensing others to use the patents.[11] In accepting such a conclusion, however, it must be recognized that the returns from self-exploitation include several imputed portions as well as the earnings of the invention itself. These include interest on the inventor's own capital investment, wages for his own labors in the enterprise, and profits for the successful enterpriser. All of these functions could be shifted to others if the inventor licensed someone to work his patent. The inventor could then devote his time to other activities. If his most efficient activity were inventing, which in many cases would not be true, his ultimate income would be maximized by devoting his time to invention, allowing others to guide the exploitation of his patents.

[11] H. R. 4523, p. 1032. Testimony of Charles Neave.

Self-exploitation of the patent, however, allows the inventor to control the product in such way as he pleases. In some fields, such as medicine, for instance, this may be an important consideration, and to some inventors it may seem more important than to others. Self-exploitation may also give the inventor a sense of independence, and considerable psychic income.

There may be some social gain as a result of the exploitation of patents by inventors. This would follow because of the many relatively small competitors. The sale or licensing of patents to others makes possible the growth of large units tending toward monopoly, with all the social consequences inherent therein. These include higher prices, poorer quality, smaller output, and the exploitation of labor.

Even though the patent is a help to the inventor when he sets out to exploit his invention himself,[12] there still are difficulties to be overcome. Any business enterprise, whether or not founded upon a patent grant, must successfully meet a number of risks. There must be a market for the product, the item must be subject to economical production, and such competition as may develop must be successfully met. And there will be competition even though a patent grant of monopoly has been obtained, for there is no such thing as a perfect monopoly. Every good competes with every other good for the consumer's dollar.

Another difficulty that has to be met in exploiting a patent is that of procuring the necessary capital. Bankers hesitate to advance funds for an untried idea.[13] They recognize that patents may be a potential liability, rather than an asset, because of possible litigation. Until it is known that a patent is valid and will not infringe on the 400,000 to 600,000 United

[12] *Ibid.*, p. 601. Statement by Frank I. Schechter.
[13] *Ibid.*, p. 1188. Statement by Val R. Lorwin.

States patents in force today, there is hesitation to invest any money in it.

A final difficulty often encountered by the inventor when he undertakes to exploit his invention himself is his lack of specialized managerial ability. It is probably exceptional to find the inventive faculty and the capacity for management combined in one person. Among the obstacles and pitfalls mentioned by the inventors studied by Rossman, it is found that "lack of knowledge" was one of high frequency.[14] Sometimes this was taken to mean lack of technical knowledge, but in many instances lack of business knowledge was referred to. The prosecution of a business to a successful conclusion requires abilities of such a high order that but few men can boast them. This is attested to by the relatively high salaries that capable business managers are able to command, owing to the relative scarcity of that particular type of labor. Lacking such ability, or not having it to the degree required for successful business experience, inventors find it exceedingly difficult to exploit their inventions themselves.

Outright sale of patents. At one end of the list of means by which a patented invention may be exploited by the inventor is manufacture by the inventor himself. At the other extreme lies the outright sale of the patent to another person or group of persons who propose to utilize it. Such "utilization" might involve putting the invention into actual production, as the inventor most likely envisaged, or completely suppressing it.[15]

There are several reasons why the purchaser of an invention might not care to work it. He would be completely within his legal rights in suppressing it, for the Supreme Court has clearly recognized the right of the owner to re-

[14] Rossman, *The Psychology of the Inventor*, pp. 162 and 173.

[15] There are valid economic reasons for the nonuse of some inventions. See Chapter X.

frain from using his patents.[16] This enables a manufacturer to buy up the patents relating to a particular industry, use any part of them and suppress the remainder. He can thus eliminate competition that would otherwise beset him.[17]

It also makes it possible to "fence-in" a given development. "Fencing-in" is of two types. In the first type the purchaser might desire the patent in order to broaden the area of his own patent monopoly by procuring sole rights to all possible methods of accomplishing the given results, and also all improvements on the various methods, whether or not they are to be utilized. He can thus assure his own position. The second type involves procuring patents on all the probable commercial developments of one's competitors in order to prevent their gaining a permanent position in the industry.[18]

Where patents are held on alternative ways of obtaining the same result, it is unlikely that more than one of the methods will be utilized.[19] It usually follows that the more efficient means is the one put into production, although this is not always true. Subsequent alternative methods may be superior to the method actually utilized, but the new method does not supersede the old one unless the average total cost with the new method is less than the average variable cost under the prevailing method. The manufacturer would not be forced to substitute the newer for the older development unless such a condition were met. If such a circumstance did exist, it would be false economy for the manufacturer to be

[16] *Continental Paper Bag Co.* v. *Eastern Paper Bag Co.*, 210 U.S. 405 (1908).

[17] Floyd L. Vaughan, "Suppression and Non-working of Patents, with Special Reference to the Dye and Chemical Industry," *American Economic Review*, Vol. IX (December, 1919), p. 697.

[18] TNEC 2, p. 473. Testimony of E. W. McCallister. See also Forkosch, *op. cit.*, p. 194.

[19] TNEC 3, p. 884. Testimony of Dr. Vannevar Bush.

concerned with his "sunk" costs. They would sooner be recovered by adopting the new method if they were recoverable at all.

When a patent is sold outright by the inventor, the purchase price becomes an overhead cost for the purchasing manufacturer, whether or not the invention is utilized. In the long run, it is necessary that the income of the undertaking be sufficient to cover all the overhead costs, as well as the variable costs, if the enterprise is to continue in production. The purchase price of the patent would normally be written off over a period equal to the life of the patent (although this might be modified by circumstances). This amortization charge would be the periodic amount of the added overhead cost.

Consider the effect of an increase in overhead cost due to the outright purchase of a patent. It is assumed that the patent is purchased but not used, and so there is no change in the technique of production nor in the product. Consequently, the only pertinent values that are changed by the patent purchase and the increase in the overhead costs to effect the amortization of the investment are those for average cost and average total cost, both of which increase.

Whether the situation be one of competition [20] or monopoly, the scale of operations and the price for the product are not affected, assuming a given demand, for the marginal cost curve does not change. The output of the firm at which profits are maximized, i. e., that at which marginal cost is equal to marginal revenue, is also unchanged by the increase in overhead cost. The profit to the manufacturer, however, decreases, the amount of the decrease depending upon the increase in average total cost.[21]

[20] It is a supermarginal producer that is considered here.

[21] It might be noted that the purchase of the patent and the increase in average total cost would result in the minimum average total cost

Granting licenses under a patent. Many times, rather than work the patent himself or sell it outright, the inventor licenses one or more manufacturers to use it [22] in return for a license fee or royalty, or combination of both. The terms of such licenses can be varied to fit the needs and circumstances of each particular case. They may give an exclusive or nonexclusive right to the invention, or they may transfer a mere shop right, fixing appropriate payments in each case.

Whether or not a patent would be licensed on an exclusive or nonexclusive basis depends very much on the nature of the invention. Radically new developments that require large amounts of capital and a considerable period of time for their exploitation will have to be licensed on an exclusive basis. To do otherwise would allow the licensee but a limited control over the situation, under which circumstances he might not care to assume the risks involved. Even when the exploiter of an invention is assured of a monopoly position he has many risks that he must bear, such as are inherent in any new development. But if, in addition to such inherent risks, there are added to them the risks of competition, the burden may be more than any licensee would care to assume. Consequently, it is to be expected that the more or less basic developments will be licensed on an exclusive basis, if they are licensed at all.

On the other hand, there are many patents that can be

(though higher) being obtained at a point of more extensive operations. The increasing cost condition would not be reached until output were further increased.

When an inventor seeks to exploit his patent by working it himself, it is correct to consider the expense incurred in making the invention and taking out the patent as an expense to be allocated over the life of the patent, the amount allocated each period being treated as a fixed cost. The above reasoning can then be applied to such a situation.

[22] A patentee may transfer his exclusive right to manufacture and sell goods embodying the patent either in whole or in part. *Virtue* v. *Creamery Package Co.*, 227 U.S. 8, 32 (1913).

licensed to advantage on a nonexclusive basis. As a general rule these are patents on minor inventions, or minor improvements of already existing devices, which can be produced by a large number of manufacturers. Many of the cross-licensing agreements that exist in industry are of a nonexclusive nature. They make available to a large number of manufacturers those developments that pertain to their field.[23] Also, some companies maintain a general policy, as does General Motors, of giving and taking only nonexclusive licenses.[24] "There is one great advantage [to granting nonexclusive licenses], and that is that where an inventor is willing to license all manufacturers to make and sell the invention, and where he is satisfied with a small royalty, there is not much incentive for any manufacturer to infringe." [25]

The nature of some inventions makes it difficult to sell them outright or to license them on the usual royalty basis. In such cases they may be marketed by selling territorial rights. A patent on such a thing as concrete road construction readily lends itself to this plan. Here the inventor might sell the entire and exclusive right to make, use, and sell the invention within the specified territory.[26] Because of the grant of complete rights under the patent this might be considered an outright sale, but to the extent that the total patent grant received from the government is parceled out piecemeal by the patentee, it resembles the granting of nonexclusive licenses.

There is another type of arrangement that comes into ex-

[23] See TNEC 2, pp. 285 ff., for testimony in respect to the automobile industry, and H. R. 4523, pp. 2 ff., for testimony in respect to the airplane industry.

[24] TNEC 2, p. 368. The policy of the Packard Motor Company appears to be similar. *Ibid.*, pp. 305–307.

[25] Ford W. Harris, "The Selling of Patent Rights," *Scientific American Supplement*, Vol. LXXXVII (May 10, 1919), p. 303.

[26] *Ibid.*

istence when inventions are made by employees. The inventions made by employees have assumed a place of increasing importance on account of the growth of industrial research by large business units. When a manufacturer employs a man to do research work, the employee is usually asked to sign a contract agreeing to assign to the employer any patents that may be procured as a result of his employment. In such cases the employer has sole rights under the patent. There are cases, however, where the employee is not requested to assign his patents to his employer. The employer has but a limited right to the invention in such a situation. For example, consider the case of a man who makes some invention on his employer's time and with his employer's equipment, relating to the employer's business, in addition to performing the regular duties for which he was hired. In such a case the employer has a "shop-right" for the use of the resulting patent.

Where an employee makes an invention in a subject related to his employer's business, discloses it to his employer, develops it on the employer's time, or with his materials, an implied contract arises and the employer is entitled to a shop-right—that is, a non-exclusive but unlimited license to use the invention for the life of any patent thereon, without the payment of any license fee, the right being limited strictly to the business of the employer (Gill v. United States, 160 U.S. 426; 16 Sup. Ct. 322; Blauvelt v. Interior Co., 80 Fed. 906; Wilson v. American Co., 187 Fed. 840; Barber v. National Carbon, 129 Fed. 370; Withington Co. v. Kinney, 68 Fed. 500.), and not being transferable except with a sale of the assets and good will of the business in connection with which it was used (Lane and Bodley v. Locke, 150 U.S. 193; 14 Sup. Ct. 78; Walker on Patents, Sec. 313a.).

Under such circumstances the employee retains the remainder of the patent right; he can license and collect license fees from others as freely as he sees fit; he can sell or mortgage the patent, in any case subject to the shop-right existing in his employer. If

the employer wishes the exclusive right, that is the entire ownership of the patent—he must, to acquire it, deal with the employee just the same as with a stranger.[27]

[27] Charles F. Murray, *The Rights of Employers in the Inventions of Employees* (Chicago: The Author, 1934), pp. 15–16.

CHAPTER IX

TERMS OF THE LICENSE AGREEMENT

THE financial terms under which a patent is licensed for use must vary to fit individual cases. One situation might call for an original license fee; another for some sort of royalty payment. A third might involve both license fee and royalty payment. A license fee is a lump-sum payment for the right to use the patent. It is made at the time of the license agreement. A royalty is also a payment for the use of a patent. The amount of the royalty is determined by the amount of the output under the patent, or the amount of the income derived from the sale of goods produced under the patent.

There are three reasons for which a manufacturer might want a license under a patent. First, he might desire to use the patent because it would enable him to reduce his costs of production. Use of the patented invention might result in greater efficiency. Such patents usually cover machinery, equipment, or manufacturing processes. Secondly, a patented invention might be desired because it would enable the manufacturer to differentiate his product and make it more marketable. Patents of this sort usually cover the product, or improvements on the product, although a new process of manufacture might so change the character of the product as to affect its marketability. Finally, a manufacturer might desire to be licensed under the patent in order to be able to suppress the invention, thereby restricting competition. This

end could only be accomplished, of course, if an exclusive license were obtained.

Analysis will now be presented for the effects upon the licensee of the various types of financial arrangements that might be found in a license agreement. Attention will be given to the costs incurred under the license, the effect of greater efficiency attained by use of the patent, and any improvements in the marketability of the product. The following cases will be analyzed as being typical:

1. License fee amortized over the life of the patent
2. Flat royalty per unit of output
3. Per unit royalty that decreases with expansion of output
4. Per unit royalty that increases with expansion of output
5. Combination license fee plus flat royalty per unit
6. Royalty stated as a per cent of selling price
7. Royalty stated as a per cent of net profits

Case 1. To show how a firm would be affected by the terms of a license agreement, it is helpful to set up an assumed situation as a starting point. This has been done in Table V, which shows the cost situation in the assumed firm before the license agreement is entered into.

The values in Table V have been calculated on the basis of the following general cost function:

$$(1) \quad TC = a + bx + cx^2 + dx^3$$

TC = total cost

a = total overhead cost

$bx + cx^2 + dx^3$ = total variable cost

x = output

In that portion of equation (1) that represents the variable costs, *b* stands for the constant unit cost elements, *c* stands

TABLE V

COSTS IN AN ASSUMED MANUFACTURING FIRM

Number of units	Total overhead costs	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	50	5	55	—	50.00	5	55.00
2	50	14	64	9	25.00	7	32.00
3	50	33	83	19	16.66	11	27.66
4	50	68	118	35	12.50	17	29.50
5	50	125	175	57	10.00	25	35.00
6	50	210	260	85	8.33	35	45.00
7	50	329	379	119	7.14	47	54.14
8	50	488	538	159	6.25	61	67.25
9	50	693	743	205	5.55	77	82.55
10	50	950	1000	257	5.00	95	100.00

for the decreasing cost elements (the value of c is minus), and d represents the increasing cost elements.

To find the different average cost values, it is only necessary to divide the various total cost values by x. Thus:

(2) $$ATC = \frac{a + bx + cx^2 + dx^3}{x} = \frac{a}{x} + b + cx + dx^2$$

(3) $$AOC = \frac{a}{x}$$

(4) $$AVC = \frac{bx + cx^2 + dx^3}{x} = b + cx + dx^2$$

In calculating the figures in Table V, the following values were assumed and substituted in the several equations:

$$a = 50$$
$$b = 5$$
$$c = -1$$
$$d = 1$$
$$x = 1 \text{ to } 10$$

Marginal cost was found by taking the differences in total costs between the successive quantities of output. Thus, the

marginal cost of five units of output is equal to the total cost of five units minus the total cost of four units. The marginal cost of six units equals the total cost of six units minus the total cost of five units. Marginal cost is always the added cost of an added unit of output.

Table VI has been prepared to show the effects of a license fee upon the costs of the firm. It has been assumed that the license was procured at a price of 170 for the full life of the patent, which is seventeen years. This is amortized over the life of the patent at the flat rate of 10 per year. Because the amortization charge does not vary with the output, it is to be considered as an addition to the overhead cost. Consequently, the total overhead costs become 60, which is the new value for *a*.

One reason for taking a license under a patent is to obtain the advantages of the lower costs that the invention makes possible. The increased efficiency that comes from utilization of the invention is reflected in the variable costs—in the value assigned to *c*, which is the efficiency factor in the equation. It is assumed that the increased efficiency is great enough in the present case to change the value of *c* from -1 to -3. For Table VI, then, the values to be substituted in the above equations are as follows:

$$\begin{aligned} a &= 60 \\ b &= 5 \\ c &= -3 \\ d &= 1 \\ x &= 1 \text{ to } 10 \end{aligned}$$

If the figures in Tables V and VI are compared, it is found that for all quantities of output, average overhead cost is greater, average variable cost is less, and marginal cost is less after taking the license and utilizing the patent than before. Average total cost is less for the larger quantities of output,

TABLE VI

EFFECT UPON COSTS OF AMORTIZING A LICENSE FEE OF 170 AT THE RATE OF 10 PER YEAR OVER THE 17-YEAR LIFE OF THE LICENSE

Number of units	Total overhead costs	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	60	3	63	—	60.00	3	60.00
2	60	6	66	3	30.00	3	33.00
3	60	15	75	9	20.00	5	25.00
4	60	36	96	21	15.00	9	24.00
5	60	75	135	39	12.00	15	27.00
6	60	138	198	63	10.00	23	33.00
7	60	231	291	93	8.57	33	41.57
8	60	360	420	129	7.50	45	52.50
9	60	531	591	171	6.66	59	65.77
10	60	750	810	219	6.00	75	81.00

but greater for the smaller quantities, after taking the license than before. In any given situation the average total cost will likely behave in this very manner. Until the output is large enough to make the efficiency factor, c, a decisive factor, the added overhead cost will result in the new average total cost being greater than the old.

The pertinent values found in Tables V and VI have been plotted on the same set of co-ordinates in Chart B. The original average total cost curve is labeled ATC, while the new average total cost curve is labeled ATC'. ATC' is the average total cost curve when the license fee and the increased efficiency are taken into consideration (Table VI). Similar markings have been used to designate the two marginal cost curves (MC and MC'), the two average variable cost curves (AVC and AVC'), and the two average overhead cost curves (AOC and AOC').

Consider now the effect of taking such a license. It is assumed, for the present, that utilization of the patent does not

differentiate the product in any way to affect its marketability. That is, the product is not changed—the demand for it remains the same. For analytical purposes it is assumed that the monopoly elements are so dominant that the situation can be considered as if it were a monopoly.[1]

For any given demand, the effect of taking the license is that the scale of operations is increased and the product is

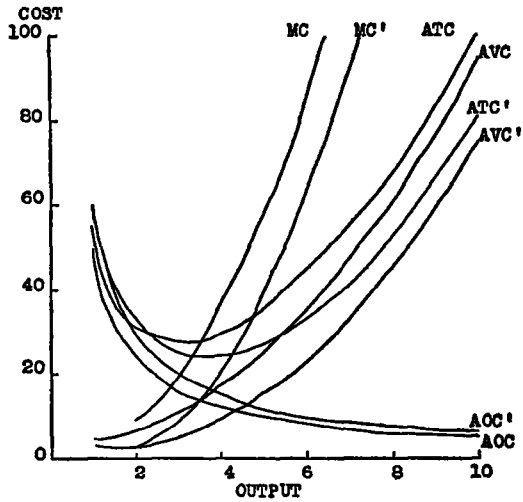

CHART B

EFFECT OF LICENSE FEE
UPON THE COSTS OF THE LICENSEE

sold at a lower price. The scale of operations is determined by the intersection of the marginal revenue curve (not shown) and the marginal cost curve. The new marginal cost curve (MC') is to the right of the old marginal cost curve (MC); therefore, the point of intersection between the mar-

[1] Justification for this assumption is found in Chapter VII.

ginal revenue curve and MC′ will lie to the right. This means that the amount of the output that maximizes the firm's net profits will have increased. The extent of the change in output will depend upon two things: (1) the elasticity of the demand curve, and (2) the improved efficiency resulting from use of the patented invention. The greater the elasticity of the demand curve, and the greater the improvement in efficiency, the greater will be the change in output. The extent of the fall in price is also determined by the elasticity of the demand curve and the improved efficiency resulting from the use of the patented invention. Price changes will be relatively small if the demand curve is highly elastic. The greater the improvement in efficiency, however, the greater will be the change in price.

It is difficult to arrive at any definite conclusion in respect to the profitableness of taking a license under a patent. Generally, it appears that any change in the total profits of the firm turns on the relative importance of the changes in profit per unit (dependent on the relationship of the demand and average total cost curves) and the quantity sold (dependent on the relationship of the marginal revenue and marginal cost curves). If the decrease in profit per unit were less, relatively, than the increase in quantity sold, the total net profit would increase.

If the manufacturer could not realize sufficient savings to meet the amortization charge when using the patent, it is unlikely that he would accept the license. If it be assumed that the patented invention does not affect his efficiency at all, the only change in the values in Table VI would be those for average overhead cost and average total cost, which would be greater. For any given demand, the quantity produced and the price at which the product were sold would not be

affected. Consequently, taking the license would reduce the firm's profits.[2]

A manufacturer might take a license under a patent without any expectation that utilization of the invention would affect the efficiency of his manufacturing operations. He might desire the use of the patent in order to differentiate his product, hoping thereby to shift his demand curve to the right. If this were accomplished, it would mean that the "product" could be sold for a higher price, and it would be produced in larger quantities. Greater profits would be made. Presumably the manufacturer would be willing to pay for the license anything up to the added profits accruing to him as a result of the product differentiation.

To arrive at the results of taking a license if use of the invention both increases the efficiency of the firm, and differentiates its "product" so that the product is demanded in greater quantities, it is only necessary to combine the two effects. The cost curves would be those shown in Chart B, but these would be considered in conjunction with an increased demand rather than the given demand. One result would be a considerable increase in quantity produced. It is impossible to determine the effect upon price, for there are opposing forces at work. The increased demand would raise the price, while the increased efficiency and lower costs would cause it to fall. These two forces tend to neutralize each other, but if one outweighs the other it will determine the price change. Profits would normally be greater.[3]

As an exception to the above, situations may be found

[2] This would be the situation if the patent were suppressed.

[3] To the extent that the monopoly price does not prevail, the effect of the license upon price, quantity, and profits depends upon further assumptions. If the competing monopolists fail to consider their full influence, a somewhat lower price will prevail. (See Chapter VII.) At the lower price greater quantities would be produced and sold, and profits would be smaller. Profits might be reduced to the competitive level (al-

where the manufacturer is not moved solely by economic or pecuniary motives, but also reacts to noneconomic incentives, such as the desire to attain a commanding position in the industry. He could accomplish this at the expense of his profits, reducing the price every time he was able to reduce his average total costs. At the end of such a program his operations would have been extended, but his profits would not have increased.

Case 2. The second case to be considered involves the payment of a flat royalty per unit of output. For illustrative purposes the costs before the license agreement is entered upon are assumed to be as represented in Table V. The terms of the license are assumed to call for the licensee to pay a royalty of 5 per unit of output produced under the patent. The total amount of the royalty depends upon the quantity manufactured, so it is a variable cost. However, it is a constant amount per unit, so it is reflected in the constant element of the variable cost portion of the total cost equation: it is reflected in the value assigned to *b*.

Table VII has been prepared to show how the firm's costs are affected by paying a flat royalty of 5 per unit of output. The figures in Table VII have been calculated from the equations given above, substituting the following values:

$$a = 50$$
$$b = 10$$
$$c = -3$$
$$d = 1$$
$$x = 1 \text{ to } 10$$

Because it is assumed that utilization of the patented invention increases the efficiency of the firm's operations, *c*, the

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though this is unlikely owing to the limited number that can enter the industry because of the existence of patents), but prices would never fall to the competitive level. See Chamberlin, *The Theory of Monopolistic Competition*, Ch. V.

efficiency factor of the variable cost component of the equation, has been set equal to −3. As in Case 1, the result is that as soon as the output is large enough to make the efficiency factor a decisive factor, the new average total cost is less than the old. (See Table V.) This shows the reason for taking the license—which is to secure lower costs through the use of the more efficient process, machinery, or equipment.

The old and new marginal cost curves (MC and MC′), and the old and new average total cost curves (ATC and

TABLE VII

EFFECT UPON COSTS OF PAYING A FLAT ROYALTY OF 5 PER UNIT OF OUTPUT

Number of units	Total overhead costs	Royalty per unit	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	50	5	8	58	—	50.00	8	58.00
2	50	5	16	66	8	25.00	8	33.00
3	50	5	30	80	14	16.66	10	26.66
4	50	5	56	106	26	12.50	14	26.50
5	50	5	100	150	44	10.00	20	30.00
6	50	5	168	218	68	8.33	28	36.00
7	50	5	266	316	98	7.14	38	45.14
8	50	5	400	450	134	6.25	50	56.25
9	50	5	576	626	176	5.55	64	69.55
10	50	5	800	850	224	5.00	80	85.00

ATC′) have been plotted in Chart C. The other curves have been omitted from Chart C for the sake of clarity. If Table VII is compared with Table V, however, it will be found that the effect of the royalty is to increase the average variable cost when the output is small. For the larger outputs, when the efficiency-promoting invention exerts a decisive influence, the new average variable cost is lower than the old. If the new and old values were plotted, the new curve would start out above the old, but would cross it and subse-

quently lie below the old. Payment of this type of royalty, based on output, does not affect the overhead costs, at least by assumption.[4]

To the extent that increased efficiency more than offsets the per unit royalty cost when the invention is utilized, price

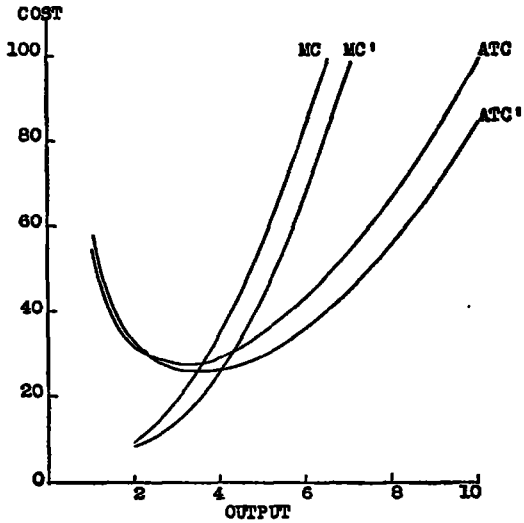


CHART C

EFFECT OF A FLAT ROYALTY OF 5 PER UNIT OF OUTPUT UPON THE COSTS OF THE LICENSEE

will be lower and quantity produced will be greater for any given demand. If the improved efficiency did not offset the

[4] This assumption may not actually fit the facts, for some new investment may be needed to put the invention into practice. This raises the problem of obsolescence. It might be that the added overhead cost would be so much as to offset the increased efficiency attained by the use of the invention, especially for the smaller quantities of output. Added overhead would not be reflected in marginal cost, so there would be no effect upon the scale of operations or the price. It would affect the profits of the firm, however, profits being smaller when the average total costs increase.

royalty expense, the new marginal cost and average total cost curves would lie above the old curves. In this situation the new price would be higher and the new quantity produced would be smaller, for any given demand. Whether or not the firm would take a license under such conditions would turn upon the amount of the net profit before and after taking the license.[5] If the demand for the product were inelastic, and the firm were operating under a condition of increasing cost, it might be possible to make a greater net profit after the license was taken and the scale of operations reduced.[6]

If the sole effect of utilizing the patented invention were a differentiated product with greater marketability, the shift in the demand curve might offset the royalty cost, thereby justifying the taking of the license. The question here turns on the relative importance of the increased demand and the greater cost. If use of the patent resulted in both a differentiated product and greater efficiency, it is likely that the firm's position would be improved, though this is not certain. This situation is similar to that considered in Case 1, above.

Case 3. Under some circumstances the inventor might grant a license specifying a royalty that becomes smaller as the amount of the output under the patent increases. Such a royalty arrangement would tend to give the licensee an incentive to operate on a large scale, securing the adoption of the product by as many people as possible. A doctor or scientist who had invented something that would benefit society might specify such a royalty arrangement in an ef-

[5] A firm operating at a loss might desire a license to use the patent, hoping to reduce its losses by taking advantage of the greater efficiency that the invention makes possible.

[6] Of course, if this situation prevailed throughout the length of the curves, the firm's profits could be maximized by producing but one unit of product, regardless of the license.

fort to have his invention introduced into general use, hoping that the lower royalty per unit when large quantities were manufactured would lead to extensive production.

An illustrative case is presented in Table VIII. The figures in the table have been computed from the equations given above. The following values have been assumed for the various elements:

$a = 50$
$c = -3$
$d = 1$
$x = 1$ to 10

When $x = 1$, $b = 15$
$x = 2$, $b = 14$
$x = 3$, $b = 13$
$x = 4$, $b = 12$
$x = 5$, $b = 11$
$x = 6$, $b = 10$
$x = 7$, $b = 9$
$x = 8$, $b = 8$
$x = 9$, $b = 7$
$x = 10$, $b = 6$

As in the above cases, it is assumed that the use of the patented invention improves the firm's efficiency. This is reflected in the value of c, which is now -3, as compared with -1 before the patent was utilized (Table V). The amount of the royalty, which falls from 10 to 1 per unit as output expands from 1 to 10 units, has been added to the constant element, b, in that portion of the equation that represents variable costs.

The effect of this royalty arrangement is shown in Chart D. As the output increases, the new marginal cost curve (MC′) and average total cost curve (ATC′) are lower than in the previous case. This means that a greater output and lower price can be anticipated for any given demand. This is the result desired by the inventor.

It is quite likely that an invention that would be licensed

TABLE VIII

EFFECT UPON COSTS OF PAYING A PER UNIT ROYALTY THAT DECREASES AS OUTPUT INCREASES

Number of units	Total overhead costs	Royalty per unit	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	50	10	13	63	—	50.00	13	63.00
2	50	9	24	74	11	25.00	12	37.00
3	50	8	39	89	15	16.66	13	29.66
4	50	7	64	114	25	12.50	16	28.50
5	50	6	105	155	41	10.00	21	31.00
6	50	5	168	218	63	8.33	28	36.33
7	50	4	259	309	91	7.14	37	44.14
8	50	3	384	434	125	6.25	48	54.25
9	50	2	549	599	165	5.55	61	66.55
10	50	1	760	810	211	5.00	76	81.00

under the terms being considered here would pertain to a product rather than to a process of manufacture. The marketability of the product would be affected, rather than the efficiency of production. Table IX and Chart E have been prepared to show the effect of such a situation.

Table IX was prepared with the assumption that the royalty arrangement was the same as in Table VIII, so the values assigned to b in the equation are the same. However, it was assumed that use of the patent increases the cost of production by more than the amount of the royalty. To introduce this into the equation the value of c was set equal to zero. The new marginal cost (MC′) and average total cost (ATC′) were then plotted in Chart E, along with old marginal cost (MC) and average total cost (ATC) curves. Assumed demand curves are also shown in Chart E. Before the product was differentiated the demand for it was as shown by the demand or average revenue curve AR, with the corresponding marginal revenue as shown by MR. After dif-

ferentiation the demand is as shown by the new average revenue (AR′) and marginal revenue (MR′) curves.

What are the results in this particular case? The new marginal cost (MC′) and average total cost (ATC′) curves lie above the old curves. This shows that the new costs, including royalties, are higher. But the demand for the "product"

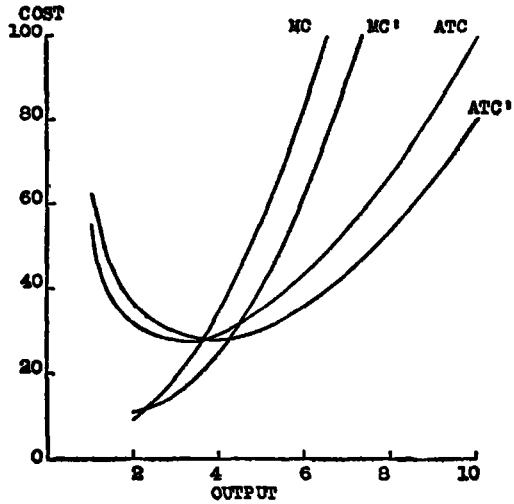


CHART D

EFFECT UPON THE LICENSEE'S COSTS
OF PAYING A PER UNIT ROYALTY
THAT DECREASES AS OUTPUT INCREASES

has increased as a result of differentiation, more than offsetting the higher costs. Price is much higher, scale of production is a little larger, average total cost is greater, and profits have increased.

In the perfectly general case it can be expected that the cost of production will be higher and the price will be higher, unless there is a very great change in the elasticity of

TABLE IX

EFFECT UPON COSTS OF A PER UNIT ROYALTY THAT DECREASES AS OUTPUT INCREASES, ASSUMING THE INVENTION UTILIZED DIFFERENTIATES THE PRODUCT AND INCREASES THE COST OF PRODUCTION

Number of units	Total overhead costs	Royalty per unit	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	50	10	16	66	—	50.00	16	66.00
2	50	9	36	86	20	25.00	18	43.00
3	50	8	66	116	30	16.66	22	38.66
4	50	7	112	162	46	12.50	28	40.50
5	50	6	180	230	68	10.00	36	46.00
6	50	5	276	326	96	8.33	46	54.33
7	50	4	406	456	130	7.14	58	65.14
8	50	3	576	626	170	6.25	72	78.25
9	50	2	792	842	216	5.55	88	93.55
10	50	1	1060	1110	268	5.00	106	111.00

the demand curve. Depending upon the shift in demand when the "product" is differentiated, the scale of operations may be greater or less and profits may be greater or smaller.

Case 4. In an effort to restrict the use of a good, an inventor might charge the licensee a per unit royalty that increases as the quantity produced increases. In this way he might hope to make it appear that the good were a luxury good, to be sold only to those having high incomes and great purchasing power. Another reason for such a royalty arrangement might be to preserve natural resources, protecting them from excessive exploitation.

If the invention were of the first type, being a luxury good catering to a limited market, it would likely be of value because it differentiated the product. The increasing royalty would raise the cost curves to a position higher than they would otherwise be, tending to assure that the "good" would continue to be a luxury. The results would be similar

to those considered in the previous case, where the costs of production were increased in order to differentiate the product and shift the demand curve to the right.

If the invention were of the second type, calling for the utilization of scarce natural resources, it might pertain to a process of manufacture, the utilization of which would

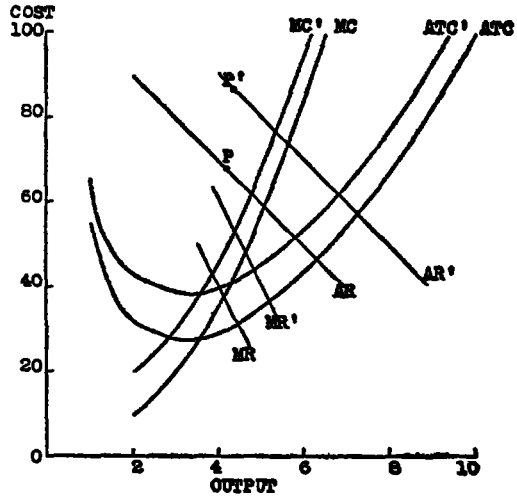


CHART E

EFFECT OF A UNIT ROYALTY THAT DECREASES AS OUTPUT INCREASES, ASSUMING THE INVENTION UTILIZED INCREASES THE COST OF PRODUCTION, BUT DIFFERENTIATES THE PRODUCT, MOVING THE DEMAND CURVE TO THE RIGHT

greatly improve the firm's efficiency. The effect of the increasing rate of royalty would be to offset part of the lower production costs achieved by use of the invention. This would raise the new average total cost and marginal cost curves above the positions they would otherwise assume. The effectiveness of such a royalty arrangement would depend upon the amount of the royalty as compared with the

amount of the savings effected by use of the patented invention.

Case 5. Many license agreements stipulate that the licensee shall pay a yearly license fee plus a per unit royalty for the use of a patented invention. These were the terms under which the Hartford-Empire Company licensed glass container manufacturers to use its automatic machinery. Table X has been prepared to show the effects of such an arrangement.

It has been assumed that the license fee is 10 per year. This being a fixed expense regardless of the amount of the output, it is added to the overhead cost in the equation $TC = a + bx + cx^2 + dx^3$. Thus, *a* becomes 60 instead of 50. (See Table V, which gives the costs before the license was taken.) The per unit royalty is assumed to be 5. It is added to the constant factor in the variable cost component of the equation, making *b* equal to 10. It is further assumed that use of the invention improves the efficiency of the firm's operations, so *c* becomes -3 instead of -1, which it was before the license was taken.

The marginal cost (MC′) and average total cost (ATC′), as shown in Table X, have been plotted in Chart F, along with the marginal cost (MC) and average total cost (ATC) that existed before the license was taken, as shown in Table V. It will be noted that as soon as the operations are extended enough to allow the improved efficiency of the new process to become effective, the new average total cost (ATC′) is less than the old (ATC). In addition, as output is expanded so the overhead can be spread over a larger output, the new curves lie farther and farther below the old ones.[7]

[7] If the license fee is relatively small and the per unit royalty relatively large, the license arrangement has little effect on overhead costs. There is very little overhead to be spread over an expanded output, and so the licensees are not driven to operate on a large scale. This appears to have

TABLE X

EFFECT UPON COSTS OF COMBINATION LICENSE FEE AND PER UNIT ROYALTY

Number of units	Total overhead costs	Royalty per unit	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	60	5	8	68	—	60.00	8	68.00
2	60	5	16	76	8	30.00	8	38.00
3	60	5	30	90	14	20.00	10	30.00
4	60	5	56	116	26	15.00	14	29.00
5	60	5	100	160	44	12.00	20	32.00
6	60	5	168	228	68	10.00	28	38.00
7	60	5	266	326	98	8.57	38	46.57
8	60	5	400	460	134	7.50	50	57.50
9	60	5	576	636	176	6.66	64	70.66
10	60	5	800	860	224	5.00	80	86.00

From the relationship of the old and new curves it follows that, for any given demand, the scale of operations will be greater and the price will be lower. Definite conclusions in respect to the profits of the licensee are not possible, for they turn on the relationship between the change in profit per unit and the change in quantity produced and sold. If the percentage increase in quantity is greater than the percentage decrease in per unit profit, the licensee's profits will increase; but if the percentage increase in quantity sold is less than the percentage decrease in profit per unit, his profits will be less after taking the license than before.

The use of the invention may make possible a more uniform product of higher quality. This appears to have been true in respect to the use of the Hartford-Empire machinery for making glass containers. Such a condition would serve to differentiate the product and improve its marketability—that is, move the firm's demand curve to the right. When

been the situation in the Hartford-Empire licenses. It was conducive to a "live and let live" policy among the competing licensees.

this happens, the scale of operations will be greater and the price will be higher. In all likelihood profits will be greater. Profits would be greater if the increased quality sold were greater, "percentagewise," than the decrease in profit per unit. This would be true except in unusual circumstances.

Case 6. In this case attention is turned to the effect of a royalty stated as a per cent of the selling price. This amounts

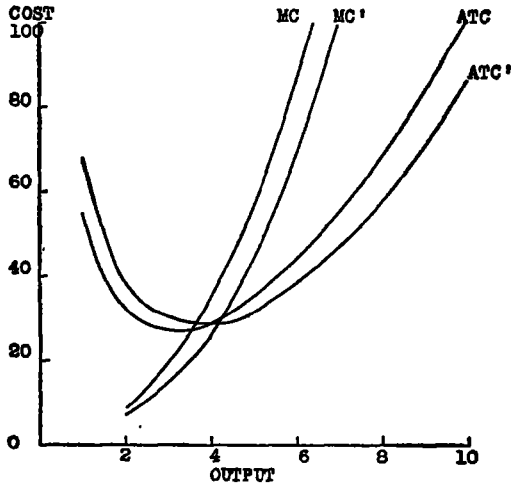


CHART F

EFFECT OF A COMBINATION LICENSE FEE AND PER UNIT ROYALTY UPON THE COSTS OF THE LICENSEE

to the same thing as a royalty based upon a percentage of the licensee's gross sales. As such, it is superior to a royalty based upon the manufacturer's net profits, for it eliminates many of the difficulties and disputes that might arise in the calculation of the net profits.

One method of analysis for determining the effect of such a royalty arrangement would be to assume a given demand and, using it to determine the price at which various quanti-

ties of output could be sold, then calculate the amount of the per unit royalty and add that amount to the variable costs. For the particular situation the royalty would then be reflected in the cost curves, and the analysis could proceed as usual from that point. This is an awkward and complicated approach to a problem that can be made quite simple.

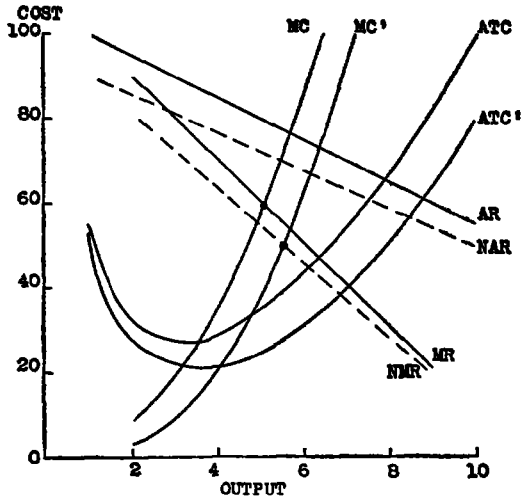


CHART G

EFFECT OF A 10 PER CENT ROYALTY BASED ON SELLING PRICE

The preferred method is to calculate the new cost curves on the basis of the improved efficiency effected by utilization of the patented invention (as has been done in Table XI). The old and new cost curves are plotted, as in Chart G. The given demand or average revenue curve (AR) with its related marginal revenue curve (MR) is also plotted. "Net revenue" curves are then plotted. The "net average revenue" curve (NAR) lies below the AR curve by 10 per cent of the

TABLE XI

EFFECT UPON COSTS OF UTILIZING AN INVENTION THAT IMPROVES EFFICIENCY

[Calculated from above equations, assuming $a = 50$, $b = 5$, $c = -3$, $d = 1$; and $x = 1$ to 10.]

Number of units	Total overhead costs	Total variable costs	Total costs	Marginal cost	Average overhead cost	Average variable cost	Average total cost
1	50	3	53	—	50.00	3	53.00
2	50	6	56	3	25.00	3	28.00
3	50	15	65	9	16.66	5	21.66
4	50	36	86	21	12.50	9	21.50
5	50	75	125	39	10.00	15	25.00
6	50	138	188	63	8.33	23	31.33
7	50	231	281	93	7.14	33	40.14
8	50	360	410	129	6.25	45	51.25
9	50	531	581	171	5.55	59	64.55
10	50	750	800	219	5.00	75	80.00

distance from the horizontal axis. Such a curve shows the *net revenue* that remains for the seller after the royalty is paid. From the "net average revenue" curve (NAR) it is possible to derive the "net marginal revenue" curve (NMR), which bears the same relationship to the marginal revenue curve (MR) that the "net average revenue" curve (NAR) bears to the average revenue or demand curve (AR).[8]

Referring to Chart G, the effects of such a royalty arrangement can be pointed out. The utilization of the patented invention improves the efficiency of the firm, lowering its cost curves. These new cost curves are to be considered in conjunction with the "net revenue" curves, while the regular revenue curves are to be considered with the original cost curves.

[8] Prices are read from the demand or average revenue curve (AR) as always. The "net revenue" curves are only utilized to determine the scale of operations and the net profits.

Before the license was taken, the scale of the firm's operations was determined by the intersection of the marginal revenue curve (MR) and the marginal cost curve (MC). After the license is taken and the royalty payments begin, the scale of operations is determined by the intersection of the "net marginal revenue" curve (NMR) and the new marginal cost curve (MC').

In the illustrative case the scale of operations would be greater, because of the great improvement in efficiency. In general, the amount and direction of any change in output depends upon the elasticity of the demand curve and the extent of the improvement in efficiency. The greater the improvement in efficiency, the more likely the increase in output. Also, the greater the elasticity of the demand curve, the greater the likelihood of expanded output. If the demand curve is relatively inelastic and there is but a small improvement in efficiency, output might actually decrease. If the scale of operations is curtailed, the price will rise, whereas if the scale of operations is expanded the price will fall. The profitableness of the license will turn upon the elasticity of the demand curve and the efficiencies made possible by the new invention. These two factors determine the relationship between profit per unit before the license is taken and profit per unit after the license is taken.

Before the license is taken, profit per unit is represented by the distance between the average revenue curve (AR) and the average total cost curve (ATC), for the determined output. After the license is taken, the profit per unit is the distance between the "net average revenue" curve (NAR) and the new average total cost curve (ATC') for the new output. Whenever the decrease in profit per unit is relatively less than the increase in output, the total net profit of the licensee will be greater.

This case is similar to the case where the license is granted in consideration of a per unit royalty that decreases as the output increases. Because larger quantities can be sold only at lower prices, as is shown by the negative slope of the demand curve, the royalty per unit decreases as the amount of the output increases, for the royalty is stated as a fixed percentage of the selling price. Furthermore, so long as the elasticity of the demand or average revenue curve (AR) is greater than unity, the total royalty that must be paid increases with each increase in output.

Case 7. The final type of royalty arrangement to be considered is that of a percentage of the net profits or net returns. Net returns are the excess of total returns over total costs of production. This type of royalty payment is analogous to a tax on net income. If there is no net income, there is no royalty to pay, whereas if the operations under the patent prove to be very profitable, the royalty charge becomes a considerable amount. Such a royalty arrangement does not change the scale of operations from that existent before the license was taken, except as the cost curves are lowered through greater efficiency, or the revenue curves are moved to the right owing to product differentiation. If such changes do result they may increase the firm's profits sufficiently so that the residual profits after paying the royalty are greater than the total net profits before the license was taken. Otherwise the licensee would be worse off, profitwise, after taking the license than before, in which case there would be little reason for taking the license.

Having considered various possible royalty arrangements and their effects upon costs, prices, profits, and output, the conclusion is that there is no easy solution to the various questions involved. There are too many variables that must

be recognized to make general conclusions possible. General tendencies can be pointed out, however.

The effect upon a firm's profits of taking a patent license depends, basically, upon the relationship between the demand for the "product" and the average total cost. This relationship determines the profit per unit. The profitableness of the license turns upon the relative change in profit per unit as compared with the relative change in output before and after taking the license. To the extent that use of the licensed patent increases the efficiency of the firm's operations and lowers its marginal cost curve, the output will be greater and the price will be lower for any given demand. If the charge for the use of the patent increases the average total cost, but not the marginal cost, output and price will not change, but profits will be less, for any given demand. Furthermore, if payment for the use of the patent causes marginal cost to increase, the scale of operations will decrease and the price will be higher. If utilization of the patent differentiates the "product" and causes the firm's demand curve to move to the right, price will be higher and the scale of operations will be greater, *ceteris paribus*. When more than one of these several factors are effective at the same time it is necessary to proceed step by step until all have been considered in order to determine the net result.

CHAPTER X

CAPTIVE INVENTORS VERSUS INDEPENDENT INVENTORS

SINCE the turn of the century, and especially since World War I, many large concerns have established research laboratories for the purpose of working out their industrial problems. The scope of the activities carried on by these laboratories has grown to immense proportions. Today the question comes to mind, "Is industrial research usurping the activity and function of the independent inventor?" Is there a conflict between the captive inventor—the inventor employed by an industrial laboratory—and the independent inventor? Is there reason to believe that the captive inventor will supersede the independent inventor, or is there a place for both in the quest for economic progress?

Industrial research—the captive inventor. Consider first the activities carried on by an industrial research laboratory. The organization of industrial research departments has been so recent that there is little standardization of operations. Such departments, however, are supported by business firms because they contribute to the progress of the firm. This can be done in two ways. First, industrial research can bring about a better understanding of the industry by developing the scientific principles upon which the industry is based. This might be referred to as basic scientific research—a

search for scientific truths and principles—which seldom leads directly to any patentable result. Secondly, industrial research may bring out new ideas which can be patented and used immediately or within a short time in the business. This type of activity is known as applied research: it consists of the application of known principles in an effort to solve existent problems. The men employed in such research departments are referred to as ". . . captive inventors, analogous to the phrase used to designate the coal mines owned by the steel companies." [1]

Except in the very largest industrial laboratories the program is chiefly concerned with developing and improving the inventions upon which the business is founded. It would be most unusual if a first patent by itself were sufficient to cover a complete new article or new process of manufacture. It often takes a great amount of development, and dozens of collateral patents, before a single successful structure is completed. Programs of this sort are properly called applied research. They encompass the entire range of activities of most industrial research departments. Some of the largest industrial units, however, have expanded their research activities to delve into the pure scientific theory that pertains to their general field. For example, the General Electric Company's scientists have made pioneering excursions into the field of optics and illumination,[2] while the Bell Telephone Laboratories make numerous investigations of a basic nature.[3]

In the broad sense of the word, research is the discovery of new knowledge by systematic examination. It can be classified on one basis into pure basic research, applied research, and research for control of a product, although there is no fundamental difference in method between pure basic research and

[1] H. R. 4523, p. 565. Testimony of Willis B. Rice.
[2] TNEC 3, p. 919. Testimony of Dr. William D. Coolidge.
[3] H. R. 4523, pp. 262 ff. Testimony of Dr. Frank B. Jewett.

applied research. In pure research men are left comparatively free to follow out their own ideas. In applied research they are of necessity guided in the direction of the interest of the company which employs them. Basic, fundamental research has been done in academic institutions, but it is now being carried on to a considerable extent by industry itself in the great industrial research laboratories.[4]

The organization of industrial research laboratories enables the scientists employed therein to achieve greater productivity. Co-operation is tremendously important. If two scientists of equal ability co-operate with one another, their output tends to be much more than twice that of either of them working alone.[5] Each contributes a good deal to the work of the other. The knowledge and experience of each complements that of the other. Co-operation, then, increases the productivity of men engaged in scientific research. This tends to make industrial research and the captive inventor of increasing importance, in relation to the independent inventor.

A clearer concept of the importance of group research may be obtained from consideration of some illustrative cases. The Bakelite Corporation, engaged in the manufacture of the materials used in producing plastics, has a total of 265 patents in force today.[6] Most of these patents were developed in the company's own research department, maintained at an annual cost of over half a million dollars. Of the total sales of the company, 95 per cent are from developments made within the organization.[7] Bakelite's research activity is almost all in applied fields; much of it is dictated by the company's customers.

[4] TNEC 3, p. 872. Summary of testimony of Dr. Vannevar Bush.
[5] *Ibid.*, p. 913. Testimony of Dr. William D. Coolidge.
[6] *Ibid.*, p. 1082. Testimony of George Baekeland.
[7] *Ibid.*, p. 1088.

In contrast to this, the General Electric Company maintains a laboratory devoted entirely to fundamental research in the electrical field. All matter is now regarded as electrical; the laboratory's activities, therefore, encompass a broad field. For this particular laboratory there is an annual expenditure of over a million dollars, in addition to the budgets of fifteen other laboratories maintained by the company.[8]

The General Motors Corporation maintains a central research department (General Motors Research Corporation) at a yearly expense of $1,200,000, and the Bell Telephone Laboratories spend from 20 to 22 million dollars a year on research.[9] About half of this amount is for fundamental scientific research. The larger companies with the larger research expenditures appear to give a greater amount of attention to basic research. This is understandable, for the large companies have a wider field of interest. It is more likely that they can find some application for the discoveries that are made. Even where a large portion of the budget is spent for fundamental investigations, however, the activities of the research department result in many patentable inventions. In 1934 the Bell System owned outright 9,500 patents, while 75 per cent of the patents actually used came from the system's own laboratories.[10]

It appears from the available evidence that programs of industrial research are not dependent upon the patent system. The Ford Motor Company's research activities are carried on without the idea of getting patents. They would be continued even though the patent system did not exist. Patents are not essential to Packard's research program either. The same is true for the General Motors Corporation, which

[8] *Ibid.*, pp. 913 and 915. Testimony of Dr. William D. Coolidge.

[9] TNEC 2, p. 332, testimony of William S. Knudsen and TNEC 3, pp. 974–75, testimony of Dr. Frank B. Jewett.

[10] TNEC 3, pp. 1158 and 965.

relies more upon efficiency than upon securing a monopoly position through patents.[11]

One reason for carrying on industrial research is to maintain the necessary efficiency so that the firm can maintain its place among competitors.

> Businesses employ [inventors] today for the production of nonpatentable inventions, and they do not do so merely for the profit which priority secures. In active competition, the condition in which new devices are most promptly imitated, no business can afford to lag behind its competitors. The reputation of a firm depends upon its ability to keep ahead, to be first in the market with new improvements in its products and new reductions in their prices.[12]

There is additional need for the activities usually carried on by a research department if monopolistic competition exists by reason of a limited number of firms competing with differentiated products. Each firm must have a research department, irrespective of the patent system, to keep its product up to that of competitors who are always trying to further differentiate. This is undoubtedly one reason for the vast outlays made by competing motorcar manufacturers.

Industrial research and the patent system. Although much of the industrial research as now known would be continued even if the patent laws were repealed, this does not mean that the big companies pass up the opportunity of procuring patent protection for the things they develop. There are several reasons why industrial research laboratories are interested in obtaining patents on their developments.

Sometimes patents are desired, not to establish a monopoly for the full period of the patent, but merely to give the developer of the new invention a head start on his competitors.

[11] TNEC 2, pp. 262, 308, and 332.
[12] Plant, *op. cit.*, pp. 43–44.

Once an item is put into production it can be duplicated or improved upon without resort to a lengthy and expensive period of experimentation. A patent assures that the new item can be introduced without being subject to the immediate competition of "Chinese copies." But patents do not preclude the development of alternative devices, which soon begin to compete. This is especially true in the automobile-parts industry.

It is not unusual for a parts company to spend a half-million or even a million dollars, and well over that in many cases, in the development of a single new part or device. The patent affords the parts manufacturer the opportunity to get his initial development and tooling expense back before his competitors start copying his device. The parts manufacturer doesn't ask for a continuous monopoly, because experience has taught him that his industry changes so rapidly and competition is so intense and so fierce in the industry that nothing that he patents today is going to continue in the form in which he patents it. It would be foolish to insure speculative capital, for example, that if he puts his money into this given part in this industry, that for 17 years we are going to continue to make this part in this given form, because we know that we must progress and that competition is going to build something better, and therefore we must build something better or we will have no business in a very few years.

All we want is a hesitation period, a head start, as we used to say when we were boys, to give us a chance to get the experimental and developmental money back.[13]

Many companies feel that the principal value of patents and patent applications is to prevent someone else from getting a patent on a similar structure. The original developer of an idea would be liable for infringement if someone else obtained a patent on a similar structure.[14] As a consequence,

[13] TNEC 3, p. 1049. Testimony of Clarence C. Carlton.

[14] TNEC 2, pp. 696–97. James McEvoy, "Reasons for Taking Out or Acquiring Patents."

many of the firms maintaining industrial research departments take out patents for the sole purpose of establishing the fact that they have made the invention. Then outsiders cannot take out patents on the same things and prevent these ideas from being used.[15]

Patents are taken out on everything a firm develops, for it is seldom possible to ascertain the importance of an invention at the time it is made. Many patents are obtained which are never utilized.[16]

The fact that so many patents are owned but not used gives rise to the charge of patent suppression. There are good reasons, however, why patents are apparently suppressed—why they are not worked. First, the progress of developmental work automatically renders many patents obsolete. They are not really suppressed; they are just impractical ideas that are scrapped in the name of progress. Second, some patents are not worked because co-ordinate technical development is lacking. Some inventions will not stand by themselves, but require complementary developments not available at the time. Third, some patents fail to be worked because the public is not yet ready to use the idea. Patents may have been taken out on experimental devices that never go into production because they fail to give satisfactory results. Finally, patents are occasionally obtained for what is a good invention, but which is not utilized because it would require that a large quantity of expensive machinery be discarded. The replacement of this machinery is so costly that it is unprofitable to use the invention.

[15] See Harry A. Toulmin, Jr., *Patents and the Public Interest* (New York: Harper and Bros., 1939), p. 85.

[16] Less than 1 per cent of General Motor's patents have proved to be valuable (TNEC 2, p. 353). International Harvester Company uses only two thirds of its patents (H. R. 4523, p. 3412). The great majority of the Ingersoll-Rand Company's patents are not used (*ibid.*, p. 3453).

There are valid economic reasons for the nonuse of patented inventions. Large holdings of unused patents, however, tend to restrict competition. This is true even though the individual patents are of little value by themselves. The huge patent structures of big firms deter small competitors from attempting aggressive policies that they would otherwise adopt. The thousands of patents held by some companies cover a broad field, and the small competitor, with limited resources to finance litigation, finds the risk of infringement greater than he can afford to assume.

Numerous proposals have been made for remedying this restriction of competition. Compulsory licensing has been suggested, while a whole group of proposals turn upon the principle of removing the "dead wood" patents. If patent owners were compelled to license all comers under those patents not actually being worked, the small competitor could apply for a license and remove one possible source of infringement litigation. This proposal might not result in any suppressed patents being put to work, but it would free industry from the restrictions imposed by the existence of the giant patent structures of the big firms. To this plan it can be objected that no distinction is made between patents that are not used because they lack merit, and patents that are not used because the invention covered therein has not been sufficiently developed. It appears to be impossible to meet this criticism, for there is no adequate means of predetermining the eventual use and importance of an invention until it is actually tested out in the market.

Those proposals which aim to remove the "dead wood" patents are of several sorts. One proposal is that 50 per cent of the patent fees be returned to the inventor if a patent is turned in and abandoned within five years.[17] The public

[17] H. R. 4523, p. 979. Testimony of Richard H. Whitehead.

would be free to use the invention if the patent monopoly were surrendered. Similar results might be obtained by levying an annual tax on all patents. This practice is followed in most foreign countries, but it appears that the purpose there is to obtain revenue rather than to eliminate worthless patents. The "dead wood" patents are effectively removed, however, for patents that do not yield enough to pay the taxes are hardly worth retaining, whether they be owned by an individual or a large corporation. It has been estimated that one half of the existing patents would be allowed to lapse if American patent owners had to pay a tax to keep their patents "alive." [18] The inventions covered by the lapsed patents would pass on to the public for free exploitation. Such a tax program would eliminate "dead wood" patents, which are of no value to their owners because of conflicting claims, yet keep others from stepping in and developing the field.

It has been noted that one reason for corporations taking out so many patents is to establish their priority with respect to a particular idea, which is not needed now but might be later. Many firms are not greatly concerned if outsiders use their inventions without paying for the privilege.[19] They are only interested in freely using the idea themselves, if and when they want to. The proposed taxation of patents would not interfere with this practice. Once an idea has been patented and passes into the public domain, it can never be repatented, for the patent system operates to retain for the public everything that is once acquired by the public. Therefore, even though a corporation's patents lapsed for nonpayment of the taxes, the corporation would still be free to use

[18] P. J. Federico, "The Death Rate of Patents," *Science Supplement*, Vol. LXXXVI (October 29, 1937), p. 10.

[19] TNEC 2, p. 258. Testimony of Edsel Ford.

the inventions involved. The only change would be that it could not prevent others from using the device.

If corporations do not care about keeping their inventions for their own exclusive use, but want to be assured of uninterrupted use, they may resort to the Class I, or technical, copyright. A copyright can be procured upon the drawings and description of the invention. The copyright does not prevent others from using the invention, but it does establish, as a matter of public record, the date that the invention was conceived. Then, if someone subsequently tries to patent the idea, it is a simple matter to establish the fact of priority and thereby prevent the outsider from obtaining the patent.[20] The corporation is thereby assured of the uninterrupted use of its invention, without preventing the development of competing firms.

The use of the copyright may point to a method of coping with the problems brought into being with the vast numbers of inventions produced in corporate research departments. Only a few corporations would likely adopt this device on their own initiative. The patent laws would have to be amended to prevent the issue of patents for inventions made by employees of corporate research departments. If corporations were then allowed to take out technical copyrights in their own name,[21] the problem would be effectively met.

There is one major objection to such a plan. The proposal makes no distinction between the usual run-of-the-mill inventions and those of a basic nature. It is probably justifiable

[20] *Purchase of Fairfax Naulty Inventions in Aviation.* Hearings before the Committee on Patents, House of Representatives, 71st Congress, 1st Session, on H. R. 720 and H. R. 721, April 18, 1930, Government Printing Office (1930). See especially p. 20.

[21] Corporations cannot take out patents in their own name. Only the true inventor can secure a patent in the United States.

to grant a patent on a basic invention, even though it is made in a corporate research laboratory. The development of a basic invention requires a considerable expenditure. It is unlikely that such an expenditure would be undertaken without patent protection. Adoption of the proposed changes would only substitute a new problem for that existing today: the recognition of a basic invention at the time of its conception. Any decision on this point would necessarily be quite arbitrary.

The independent inventor. Although there has been a rapid growth in the number of inventions made in industrial research laboratories, the independent inventor still remains of paramount importance. This can be demonstrated with statistics made available by the United States Patent Office. The only measures of inventive activity are the number of patent applications and the number of patents issued. Approximately one half of the applications for patents are for ideas that are not patentable, for one reason or another. Although the number of patent applications is an indication of the amount of inventive activity, the number of patents actually issued is a better index of the amount of invention; patents cannot be obtained on ideas that do not amount to invention, as legally determined.

In 1938, individuals received 42.9 per cent of all the patents issued by the Patent Office.[22] Inventions covered by these patents were clearly made by independent inventors. In addition, many of the patents issued to small corporations were made by inventors employed outside corporate research departments. Mechanics and engineers employed by small corporations frequently assign their inventions to their employers, for the inventions relate to the field of employ-

[22] TNEC 3, p. 1127. Material prepared by the United States Patent Office.

ment, that is, to the business of the employer. Few small corporations maintain separate research departments, but rely upon the independent activities of the "bright young fellows" employed about the plant.[23] Thirty-four and one-half per cent of the patents issued in 1938 went to small corporations.[24] Of all the inventions that were patented in the United States in that year, 77.4 per cent were made by independent inventors, if the patents issued to individuals and to small corporations are considered to cover inventions made by independents. Only 17.2 per cent were made by large corporations and their subsidiaries.[25]

These figures establish the predominance of inventions made outside the great industrial research laboratories, percentagewise, but they fail to portray the relative importance of the inventions made by either group. No figures can be cited on this point. Reliance must be placed upon the value-judgments of men familiar with the situation.

Dr. Vannevar Bush, president of the Carnegie Institution, is "quite sure" that ". . . while a great research laboratory is a very important factor in this country in advancing science and producing new industrial combinations, it cannot by any means fulfill the entire need. The independent, the small group, the individual who grasps a situation, by reason of his detachment is oftentimes an exceedingly important factor in bringing to a head things that might otherwise not appear for a long time." [26] Dr. Frank B. Jewett, president of the Bell Telephone Laboratories, holds a similar opinion. While ". . . there are certain sectors where the independent

[23] *Ibid.*, pp. 930–31. Testimony of Ralph E. Flanders.

[24] *Ibid.*, p. 1127. While corporations may receive patents, they cannot apply for them.

[25] *Ibid.* Large corporations were defined as those having over $50,000,000 assets. *Ibid.*, p. 846. There were 450 such corporations. Foreign corporations received the balance, 5.4 per cent, of the patents issued.

[26] *Ibid.*, p. 872.

inventor cannot operate; he never could, cannot now, and never will be able to operate . . . the chances are 10 to 1" that fundamental inventions will come from outside the big laboratories ". . . in the majority of cases. . . ." The great bulk of the inventions relating to developments and improvements of a field of activity are likely to come from the industrial research laboratories of the large corporations but, ". . . those few fundamental patents, the things that really mark big changes in the art, are more likely to come from the outside than from the inside." [27]

Corporate research laboratories mistrust radically new ideas.[28] They tend to be conservative, to confine themselves to "canned work." They are chiefly concerned with the development and improvement of the inventions upon which their business is founded. They do not attempt to produce epoch-making new inventions. Such inventions would not be in their line of business.

Research work financed by the profits of large corporations is usually for the specific purpose of perpetuating and extending their control of the market and of increasing their profits. The researcher's work is therefore largely confined to the development of practical improvements on devices in current use, and is not directly concerned with novel developments that will change decisively established manufacturing processes.[29]

Once a line of development is indicated by a basic invention, the activities of industrial laboratories assure an orderly development of the idea. Dr. Jewett has pointed out that it would have been impossible for separate, independent inven-

[27] *Ibid.*, pp. 971 and 976.

[28] See H. R. 4523, pp. 656–57. Testimony of Karl Fenning.

[29] Bernhard J. Stern, "Restraints upon the Utilization of Inventions," *Annals of the American Academy*, Vol. CC (November, 1938), p. 23. This article cites figures compiled by William M. Grosvenor to the effect that only 12 of the 75 basic and radically new inventions made between 1889 and 1929 were produced by corporation research.

tors to work out a co-ordinated telephone system.[30] The efficiency attained by the American telephone system is the result of a planned attack upon the problems that have been encountered. "Once upon a time industry waited like Mr. Micawber for something to turn up. Nowadays industry turns it up itself." [31] Organized group research provides the facility for an intelligent attack upon any technical problems that may arise.

I think it is safe to say that almost any one of our great industrial-research laboratories could, if the occasion arose for directing its whole attention to an attack on the problems of some foreign industry, produce values within the patent system which would be a major threat to the stability of that industry. Put another way, it is quite within the bounds of possibility to conceive of a modern industrial-research laboratory, entirely unconnected with any particular industry, directing its engines of creation against various industries and creating values within the patent system of such importance as to develop major problems for each industry attacked. These problems might be either in the way of large monetary payments for rights or because of the development of new competing units. In such form the industrial-research laboratory would be the modern counterpart, in giant's clothes, of the free-lance inventor of an earlier time, with whom we are all familiar.[32]

Industrial research in the United States has not been undertaken with this in mind. Industrial research departments have been considered as service departments. They have been established to solve the technical problems of the business. It has not been considered their proper function to undertake fundamental research or inventions that might establish new industries. These activities have been left to

[30] H. R. 4523, p. 283.

[31] *Ibid.*, p. 872. Testimony of Waldemar Kaempfert.

[32] Frank B. Jewett, "Modern Research Organizations and the American Patent System," *Mechanical Engineering*, Vol. LIV (June, 1932), p. 398.

independent investigators who have no professional reputation at stake—who have nothing to lose. The independents are not bound by precedent or prejudice. They are not concerned with the obsolescence of corporate investments. Furthermore, basic inventions are as different from their most closely related fields as from any other field. If such epoch-making developments were to come from corporate research laboratories, the corporation would not be in its own line of business if it exploited the invention. It is just as easy, if not easier, for a new corporation to be formed to exploit the invention as for an already established company to expand its activities to include the new field.

In view of the importance of the individual inventor, quoting Dr. William M. Grosvenor ". . . it is vastly important for us to know it and to adapt our patent system to give the most perfect protection to the individual, because the nation and the race must rely chiefly on the individual for those great strides of progress, those quick adaptations, which prove its 'fitness to survive.' Then if the large corporations fail to function co-operatively in any particular instance, the outside seeds of progress will not necessarily be neglected or killed; a new corporation can be created to foster it and the old one left to take care of itself." [33]

Effective competition requires that there be a large number of firms. Active, independent inventors tend to assure the existence of competition. Their patents provide the basis for the establishment and continuation of many small business units. The competition of many small manufacturers is socially desirable. It results in a more diversified production of goods and stimulates every producer, large and small, continually to improve his product and lower his prices.

The patent system and the system of research laboratories,

[33] Quoted in Rossman, *The Psychology of the Inventor*, p. 34.

taken together, provide a means of effecting industrial concentration. It is possible for a firm to dominate an entire industry by building up a patent structure of several thousand patents. A firm can inject itself into other fields altogether separate from that for which it was originally organized if it exploits fundamental inventions made by its research department. If patents are taken out on the inventions, others can be restrained from competing. The result is industrial concentration.[34]

Conclusion. The number of inventions made by independent inventors still exceeds that made by captive inventors, although the number made in corporate research laboratories has led some persons to conclude that the day of the independent inventor has passed. It is probably true that more and more of the patents issued by the United States Patent Office will be for inventions made in research laboratories. But to recognize this is not to say that the importance of the independent inventor is decreasing. On the contrary, it might be argued that the independent inventor assumes an ever greater importance as a larger portion of American patents spring from corporate research.

The relative importance of the captive and the independent inventor can only be determined after considering the nature of the inventions made by each, as well as the number. Patents taken out by captive inventors tend to relate to the development of existing inventions or to efficiency-promoting, cost-reducing inventions. Very few basic inventions have come from corporate research laboratories. Most pio-

[34] This is a real problem. The research activities of the American Telephone and Telegraph Company resulted in a patent structure which, under the name of Electrical Research Products, Inc., established control over the newly developed talking picture machine and public address equipment industries. See H. R. 4523, pp. 435–536. Testimony of Clarence C. Colby, Joseph A. Numero, and Sidney R. Kent.

neering inventions have been conceived by independent inventors.

If independent inventors should cease to be active—if basic, factor-using inventions were not forthcoming—the economy would be thrown out of balance. Agents of production, released by the application of efficiency-promoting inventions, would fail to be absorbed. Unemployment and unused resources would exist side by side.[35] A balanced economy cannot be achieved unless there is a parallel development of factor-using and factor-saving inventions. Many factor-saving inventions are made by captive inventors in industrial research laboratories. Most basic, factor-using inventions, however, are made by independent inventors. The activities of independent and captive inventors are complementary. The activities of independent inventors tend to satisfy new wants, while the activities of captive inventors tend to result in improved means of satisfying old wants.

Corporate research has not removed the need for independent inventors. Reliance must still be placed upon independent inventors for revolutionary developments. This raises the question, "Do independent inventors receive adequate support and protection, considering the competitive disadvantage under which they function?" The kind of patent system that best serves the laboratory adjunct of a great corporation would not serve the interests of independent inventors. It has been suggested above that some form of the technical copyright might solve the problems created by industrial research. Another solution might be to raise the requirements for patentability and to establish a system of minor patents, such as the German *Gebrauchsmuster*, for developmental inventions which comprise the vast majority of those made in corporate laboratories.

[35] This situation was considered in Chapter I.

CHAPTER XI

PATENTS AND INTERNATIONAL TRADE

PATENT monopolies do not extend beyond national boundaries. They are not recognized by foreign countries. As soon as the patentee steps beyond his own national borders to exploit his invention, he finds himself without the benefit of his patent. He must operate as though no patents exist, or take out patents in the foreign countries. The number of patents that inventors take out in foreign countries is really amazing. The United States Patent Office has tried to collect the facts on this practice, which are presented in Table XII.

Americans take out many more patents abroad than foreigners take out in this country.[1] The number and character of the inventions patented in foreign countries has led Lawrence Langner, international patent solicitor, to state that in his opinion ". . . the inventions that come from America and go to Europe are twenty times more valuable than the inventions which come from Europe and go to America." [2]

[1] The inventors of only two countries take out more patents in the United States than Americans take out in their countries. Swiss inventors obtained an average of 311 American patents per year from 1930 to 1937, while American inventors took out but 274 patents per year in Switzerland. Germany granted an average of 1,355 patents per year to American inventors during the same period, while Germans obtained an average of 2,375 patents per year in this country. TNEC 3, p. 1151. It appears that the large number of German inventions patented in this country is due to the extensive activities of the German chemical industries.

[2] H. R. 9259, p. 409.

TABLE XII

AVERAGE NUMBER OF PATENTS GRANTED BY VARIOUS COUNTRIES FOR THE EIGHT YEARS 1930–1937, SHOWING THE PROPORTION GRANTED TO FOREIGNERS *

	Average annual number of patents granted	Number granted to foreigners	Per cent granted to foreigners
United States	48,697	6,421	13.2
Germany	20,621	5,327	25.8
France	20,025	9,994	49.9
Great Britain (1930–35)	18,417	9,522	51.7
Italy	10,634	6,782	63.8
Canada	9,269	8,368	90.3
Belgium	7,315	....	...
Switzerland (1930–36)	7,307	4,066	55.6
Japan (1930–36)	4,845	1,165	24.0
Austria	4,475	....	...
Czechoslovakia	3,613	2,749	76.1
Sweden	2,840	....	...
Holland (1930–35)	2,674	2,164	80.9
Australia	2,460	....	...
Hungary	2,334	....	...
Poland	1,845	....	...
Denmark	1,590	1,056	66.4
Norway	1,428	1,031	72.2
Roumania	1,078	....	...

* TNEC 3, p. 1152.

Use of patents to control international competition. There are several ways in which patents can be used to advantage in international trade. When inventors take out patents in the several countries of the world, those patents establish a

monopoly over the inventions in the various countries.[3] In this way patents can be used to establish protected foreign markets. Others can neither produce nor sell the invention in the foreign countries without the patentee's permission. The German chemical industries were able to reserve the American market in this way before World War I. During that war the United States government confiscated the German patents and established a system for licensing American manufacturers to use them. The extensive American chemical industries date from that time. During the period of peace following World War I, however, German interests rapidly reinstated their position of patent control over the American chemical industry.[4] This practice is objected to by many people.

It is a contravention of our patent law and an economic injustice to the American manufacturer to allow a foreigner to take out a patent in this country merely for the purpose of reserving the United States as a market for his patented product, which is manufactured abroad exclusively. It means the exclusion of all other would-be inventors and competitors from the industry covered by the patent and at the same time, the building up of the industry in other countries, all to the detriment of the United States.[5]

Almost all foreign countries require that patents be worked within the country in order to meet the situation complained of above. The working provisions in the patent laws of foreign countries have been designed to encourage

[3] By taking out patents only in the industrial countries it is usually possible to stop competition at its source. It is unnecessary to patent an invention in all foreign countries. See Harry A. Toulmin, Jr., *Patent Law for the Inventor and Executive* (New York: Harper and Bros., 1928), p. 42.

[4] H. R. 4523, pp. 740–75. Testimony of Francis P. Garvin.

[5] Vaughan, "Suppression and Non-working of Patents," p. 700.

domestic industry,[6] although occasional attempts have been made to use them in an effort to force suppressed patents into use.[7] Working provisions have been incorporated into foreign patent laws to meet a situation that is handled by protective tariffs in the United States. The patent monopoly is absolute in the United States. It is not conditioned upon the patent's being worked.

The penalty in some countries for not working a patent has been revocation of the patent; but most foreign countries now provide that if the monoply rights are abused, interested parties may apply to the proper government authorities for a compulsory license under the patent. After proper investigation, the license is granted if it appears that domestic working of the patent is in the public interest.[8]

The principal advantage in Great Britain of compulsory licenses has been to convert the importation of patented articles from abroad into increased manufacturing in England. In view of the peculiar conditions that exist in England, this is a most advantageous thing for the public interest, but exactly the reverse is true in the United States, where we have no problem of endeavoring to increase our business by encouraging the manufacture of articles that are made abroad. Our tariff regulations have been utilized for that purpose in a traditional American fashion.[9]

The compulsory working and compulsory licensing provisions of foreign patent laws are not as inclusive as the protective tariff. Their application is quite limited: they can be applied only to patented articles. They are not methods of encouraging domestic industry in general. On the other hand, a protective tariff can be used to foster every industry

[6] Royal E. Montgomery, "International Aspects of Patent Legislation," *Journal of Political Economy*, Vol. XXXI (February, 1923), p. 94.

[7] TNEC 3, pp. 1025 ff. Testimony of Lawrence Langner.

[8] H. R. 9259, p. 413. Testimony of Lawrence Langner.

[9] Toulmin, *Patents and the Public Interest*, p. 82.

believed to be in the public interest, regardless of the patent requirements.

The basis for objecting to a protective tariff is well known. A protective tariff prevents the operation of the law of comparative advantage. If artificial barriers, such as a tariff, do not interfere, a country that is less favorably equipped for a special kind of production yields to the country that is particularly well prepared to produce the goods in question. It is clearly to the advantage of American consumers to import the low-cost foreign goods rather than to patronize high-cost domestic manufacturers protected by a tariff. If consumers are forced to purchase high-cost domestic goods because of a protective tariff, they are exploited.

The same conclusion holds when patents are involved. Consider the chemical industries. German interests patent their products in the United States. These patents prevent American firms from manufacturing the product. Germany has a protected market here and can charge an excessively high price. But, even though a high price is charged, that does not necessarily mean that the profits are increased by producing the good in Germany. The German company's profits would be greater by manufacturing the good in the United States if the American costs of production were lower than the costs in Germany. The fact that foreign inventors take out patents in the United States and manufacture abroad establishes, prima facie, that foreign costs of production are lower than domestic costs would be. This would likely be true if the foreign industry were sufficiently advanced to make the invention earlier than American inventors. Specialized techniques would prevail in the foreign country. Specialized labor and abundant resources of the required kinds would help to give the foreign firms a comparative advantage. Production would take place in the for-

eign country in the absence of patents. Just because the foreign producer takes out a patent in the United States, he should not be required to produce here if costs of production are lower abroad. Compulsory working of patents and the protective tariff are condemned for the same reason: they prevent the operation of the law of comparative advantage.

If the patented product could be produced more cheaply in the United States, it would be to the advantage of the foreign patentee to establish a plant here. This would not affect the price obtainable for the product, but it would reduce the cost of producing it. The result would be greater profits for the patentee. In a capitalistic economy where freedom of enterprise prevails, the businessman normally tries to maximize his net profits. Production is carried on in that country where costs are lowest. Regardless of the existence of patents, the law of comparative advantage would determine the *locus* of production.

Compulsory working laws, compulsory licensing laws, and protective tariff laws are all designed to interfere with the functioning of the natural economic forces. They are nationalistic. They are shortsighted. They prevent consumers from satisfying their wants as cheaply as possible. They are steps that lead away from a free economy.

Patents can also be used to protect the inventor's domestic market. The grant of a patent monopoly carries with it the right to exclude all importations of the patented article. A patent, in effect, establishes a private tariff barrier about the country. If the inventor does not wish to allow importations of the patented good, it is within his power to have the good excluded. The courts will grant an injunction against importations unauthorized by the patentee.[10] In the case of

[10] The General Electric Company obtained an injunction against the

Boesch v. *Graff* [11] the Supreme Court held that where an invention was patented in a foreign country and also patented in the United States, articles embodying the invention could not be imported from the foreign country without a license from the owner of the United States patent. With power such as this the inventor is assured of a domestic market unmolested by competition from abroad.[12]

The fact that a company's product is patented in this country does not prevent foreigners from taking out patents on substitute or improved devices. They would then be able to sell in this country in competition with the domestic producer. To prevent this, producers in the several countries cross-license each other and agree not to compete in each other's markets. If the foreign producer has patents in the United States, the American company gets the exclusive right to use them in this country in exchange for giving similar rights to its patents in the foreign country. In this manner the General Electric Company has eliminated the possible competition of all foreign producers of incandescent electric light bulbs in the American market.[13]

When an inventor has taken out patents in several different countries, he has a number of separate patent monopolies, each independent of the others. The markets in the various countries are effectively separated. The patent monopolist is thereby enabled to sell the same article to different buyers at different prices. This is known as price discrimination.

It often happens that a monopolist finds it possible and profitable to sell a single commodity at different prices to different buyers. This can occur when he is selling in several markets

importation of Japanese electric light bulbs that infringed G-E patents. See H. R. 4523, p. 313. Testimony of Gerard Swope.

[11] 133 U.S. 697 (1890).

[12] Forkosch, *op. cit.*, p. 419.

[13] TNEC 25, p. 13072. Testimony of Dr. Theodore J. Kreps.

which are divided from one another in such a way that goods which are sold in the cheaper market cannot be bought from the monopolist and resold in the dearer market; and when customers in the dearer market cannot transfer themselves into the cheaper market to get the benefit of the lower price. The act of selling the same article, produced under a single control, at different prices to different buyers is known as *price discrimination.*[14]

The inventor can separate the market in country A from the market in country B by taking out patents in each country. Goods cannot be taken from one market to the other by traders because of the exclusive nature of the patents; and the relative immobility of consumers prevents their going into a cheaper market in a foreign country to get the benefit of a lower price. National markets can be effectively separated, then, by taking out patents on an invention in the several different countries.

It may be to the patentee's advantage to charge different prices in the different national markets when they can be separated in this way. This is true if the demand for the products is different in the separate markets. Price discrimination is profitable if the elasticity of demand in the separate markets is not the same.

The existence of price discrimination . . . depends on a difference between the elasticities of the demands in the markets in which it is possible to sell. If the demand curves of the separate markets were iso-elastic, so that at any price the elasticity of demand was the same in each market, then the same price would be charged in all of them; for when the marginal revenues were equal in each market, the prices would then also be equal, and the result would be the same as though the market were not divisible.[15]

[14] Robinson, *The Economics of Imperfect Competition*, p. 179.
[15] *Ibid.*, p. 185.

The patent monopolist can ". . . increase his profit by selling less in those markets where the elasticity of demand is less and the marginal revenue smaller, and selling more in those markets where the elasticity of demand is higher and the marginal revenue greater." [16] He can maximize his profits by so adjusting his sales in the various markets that the added revenue obtained from selling an additional unit of output in any one market is the same for all the markets. His ". . . profits will be at a maximum when the marginal revenue in each market is equal to the marginal cost of the whole output." [17]

The determination of prices is shown in the following illustration.[18] The demand for the product in country A is that shown by the curve D_1 in Chart H, while the demand for the product in country B is shown by the curve D_2. MR_1 and MR_2 are the respective marginal revenue curves. To obtain an aggregate demand curve AD, sum the two demand curves (D_1 and D_2) laterally. The curve AD shows the total amount that would be sold at each price if the price were the same in both markets. The marginal revenue curves are summed laterally in the same way. The result is the aggregate marginal revenue curve AMR. This curve shows ". . . the amount of sales that would correspond to each value of the marginal revenue if the marginal revenue were the same in both markets." It shows the marginal revenue that can be obtained by the patent monopolist.

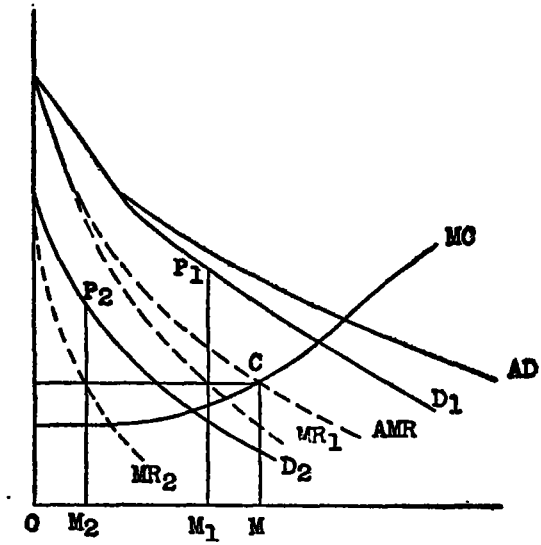
The output that will maximize the monopolist's profits

[16] *Ibid.*, p. 181.

[17] *Ibid.*

[18] This is the method adopted by Mrs. Robinson to determine the prices in the different markets when price discrimination is possible. *The Economics of Imperfect Competition*, pp. 182–83. It is here applied to the particular situation that arises from the fact that patent monopolies stop at national boundaries.

when there is price discrimination is determined by the intersection of the marginal cost (MC) and aggregate marginal revenue (AMR) curves, as at C in Chart H. The total output will be OM. The sale of this output will be divided between the markets of countries A and B. The amounts sold in the two markets will be such that in each the marginal revenue is equal to the marginal cost of the whole output. Thus, OM_1 quantity will be sold in country A, for when this quantity is sold in that market, marginal revenue (as read from MR_1) is equal to the marginal cost of the total output. Likewise, OM_2 quantity will be sold in country B. The sale of this quantity equates marginal revenue (shown by curve MR_2) with the marginal cost of the total output.



[Reproduced from Robinson, *The Economics of Imperfect Competition*, p. 183.]

CHART H

PRICE DISCRIMINATION BETWEEN TWO MARKETS

The quantity sold in country A (OM_1) plus the quantity sold in country B (OM_2) equals the total output (OM). "Whether marginal costs are constant, rising, or falling, output will be determined by the point at which the aggregate marginal revenue curve cuts the marginal cost curve, and the amount sold in each market will be the amount for which marginal revenue is equal to the marginal cost of the whole output." [19]

The price in each market is read from the demand curve pertaining to that market. Thus, when the quantity OM_1 is sold in country A, the price is P_1, as read from the demand curve D_1. Reading from the demand curve D_2, the price in country B is P_2 when OM_2 quantity is sold.

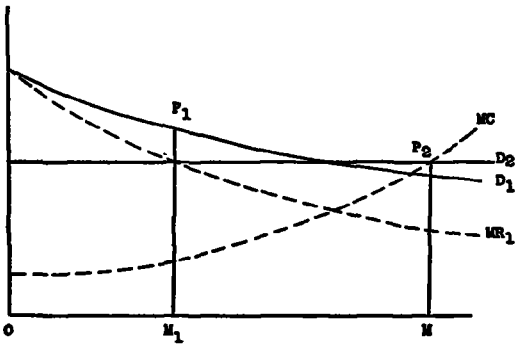
The net profits of the patent monopolist are equal to the total revenue minus the total costs. In Chart H this is equal to the area lying under the aggregate marginal revenue curve (AMR) *minus* the area lying under the marginal cost curve (MC).

The above analysis demonstrates one way in which patents can be used by an inventor to increase the net income from his invention. It presupposes that patents have been obtained in the various countries where the invention is marketed. This may not always be possible. It is impossible to patent all products in some countries: for example, Germany does not grant patents on food products. If an American inventor developed a new food product, he could get patent protection in this country. His home market would then be protected from direct competition. But, not having patent protection in Germany, he might be faced with the competition of German manufacturers in the German market. That competition might be so great that the demand for his product would be perfectly elastic. His individual demand curve

[19] Robinson, *The Economics of Imperfect Competition*, p. 183.

would be a horizontal line. The marginal revenue curve would also be a horizontal line, superimposed upon the demand or average revenue curve. How would the inventor react to this situation?

Selling price and marginal revenue would be equal in the foreign unprotected market of country B. The patentee, as



[Reproduced from Robinson, *The Economics of Imperfect Competition*, p. 184.]

CHART I

PRICE DISCRIMINATION BETWEEN TWO MARKETS, ONE MONOPOLIZED AND THE OTHER COMPETITIVE

in the previous case, would regulate his sales so that the marginal revenue in the two markets is equal. But the marginal revenue and price are the same in country B. Therefore, the amounts sold will be such that the marginal revenue in the protected market, country A, will be equal to the price in the unprotected market, country B. Furthermore, the total output will be regulated so that the marginal cost of the whole output is equal to the price in country B.

In Chart I, the intersection of the perfectly elastic demand curve of country B (which is also the marginal revenue curve for that market) with the marginal cost curve (MC) determines the total output. The quantity sold in the protected

market of country A is such that the marginal revenue there is equal to the marginal cost of the total output. Thus OM_1 quantity would be sold at the price of P_1. The balance of the total output (M_1M) would be sold in the unprotected market of country B at the prevailing competitive price P_2.

It is no longer true that the amount sold in each market is that amount for which marginal revenue is equal to the marginal cost of the whole output. If this were still true the whole output would be sold in the competitive market of country B. If output were increased in order to make sales in the protected market of country A, marginal cost would be rising above marginal revenue. Therefore, part of what could be sold in country B is sold in country A, so far as the marginal revenue from such sales is greater than the marginal revenue that could be obtained by selling in country B.

A lower prevailing price in country B would lower the demand curve D_2. Total output would be reduced. Sales in the monopolized market of country A would increase, while sales in country B would decrease. If the price in country B fell below the level at which the marginal revenue curve for country A cuts the marginal cost curve, no sales would be made in the unprotected market of country B.

Cross-licensing and international co-operation between firms. Ways in which patents taken out in different countries can be used to control competition have been considered above. Emphasis was placed on excluding competitors by means of the patent monopolies. This is not always the end desired when foreign patents are procured. Not all firms wish to expand their markets to include all the countries of the world. Many attain such size in exploiting their own domestic market that it is deemed unwise to try to operate in foreign markets.[20] But they continue to take out patents

[20] A condition of increasing per unit cost of production would have a bearing here.

abroad. Foreign patents are often the consideration in effecting co-operative agreements with firms in other countries.

Cross-licensing and patent exchange agreements between firms in different countries can be used for the following purposes: to meet the requirement of compulsory working; to dispose of markets protected by high tariff barriers or nationalistic schemes of exchange control; to effect the interchange of technical information; and to allocate international markets between competitors. Any one or several of these purposes may be served in a given agreement.

Practically all foreign countries have compulsory working and compulsory licensing provisions in their patent laws. These are designed to force the foreign patentee to transfer at least a part of his manufacturing operations into the country, or to make it possible for domestic manufacturers to operate under the patent. By assigning his patent to a domestic manufacturer of his own choice, the foreign patentee can usually avoid difficulties on this score.

The resurgence of the spirit of nationalism after World War I, with the concomitant raising of tariff barriers, even by England, the traditional stronghold of free trade, has provided another use for foreign patents. Rather than try to send goods into a country over the tariff barriers, patentees have sought manufacturers within the protected markets who can utilize the patented inventions to their mutual advantage.

A concurrent requirement of many German industrialists, faced with a prohibitive tariff wall around the American market and unable to sell in this market is some arrangement for the sale of their patents and processes to American firms on either a royalty or outright purchase arrangement. Incidentally, American industry, finding it more and more difficult to compete in Germany because of lower German costs are anxious in turn to

sell their rights to good German companies and, if possible, retain an interest in the profits. As the whole thing works out, circumstances all point to a more or less general exchange of German and American patents and processes. . . .[21]

In the period after the above passage was written there was even greater incentive for international patent exchanges. In addition to tariffs, many other restrictions were placed upon trade between nations. Systems of exchange controls and exchange rationing were established by some countries, while others set quotas limiting the amount of imports. In 1932 the A. G. Fuer Amerika Interessen was established to act as middleman in arranging for the sale or lease of patents and manufacturing licenses by manufacturers who found their foreign markets cut off by trade restrictions. It was reported that within a few days after the plan was announced in Germany commitments had been received from more than 1,000 leading German manufacturing companies. Comparable interest was shown in France and England.[22] The immediate response to this undertaking is evidence of the desire of industrialists to make some disposition of foreign patents which cannot be put to effective use.

The Radio Corporation of America has a reason for entering into cross-licensing agreements with foreign companies that is more or less peculiar to its own special type of business. Its initial patent exchange agreements were entered into as supplements to traffic agreements with companies abroad, where foreign ownership or operation of radio stations is not permitted. Both RCA and the foreign companies were eager that the communication circuits should have the best possible apparatus. To this end they pooled their pat-

[21] Emmett Harris, "The New Hook-Up with Germany," *American Bankers Association Journal*, Vol. XXII (July, 1929), p. 47.

[22] "Patent Exchange Aimed at Barriers," *New York Times*, September 22, 1932, p. 38.

ents.[23] RCA was thereby assured adequate outlets for its foreign business.

The international pooling of patents makes immediately available to the participating firms an immense amount of research and the accumulated practical experience embodied in the patents that are cross-licensed. In addition, an important feature of many agreements is the provision for the exchange of technical and manufacturing information between the parties. This is true of most of the RCA agreements.[24] It is also true of the cross-license agreement that was effected between Siemens and Halske, of Germany, and the Beryllium Corporation, an American company.

The process of producing beryllium metal, and the uses to which the metal can be applied, are recent laboratory developments. The Beryllium Corporation carried on research work for a number of years before starting to apply for patents to cover its developments. At that time it was found that Siemens and Halske had already taken out a number of American patents in respect to beryllium. After several years of negotiation, the Beryllium Corporation completed an agreement with Siemens and Halske effecting co-operation between the two companies and the interchange of information and patents. The agreement also included the allocation of international markets.[25]

Patent agreements between firms engaged in similar activities in different countries have been used as a basis for the allocation of world markets. The Owens-Corning Fiberglas

[23] Otto S. Schairer, *Patent Policies of Radio Corporation of America* (New York: RCA Institutes Technical Press, 1939), pp. 30–31.

[24] *Ibid.*, p. 33.

[25] TNEC 5, pp. 2024 ff. Testimony of Andrew J. Gahagan. By the terms of the original agreement, each company was to pay royalties for the use of the other's patents. This arrangement was subsequently abandoned because of the restrictions that the German government placed upon foreign interests receiving income in Germany. *Ibid.*, p. 2045.

Corporation is a party to several patent agreements that accomplish this result, as well as procuring the use of technical information and American patents owned by foreign companies.[26] The Fiberglas Corporation reserved for itself the exclusive rights to all the North American market. The British Empire, excepting Canada, was allocated to Chance Bros. & Co., Ltd., of Scotland. A French company was given exclusive rights to manufacture and sell the patented products in France and its colonies and possessions. An Italian company was given similar rights for Italy and the Italian colonies and possessions. One Dutch company was given exclusive rights in Germany and Holland, while to a second Dutch company was allocated the rest of the world.

The parties to these several agreements undertake to keep their products from being exported from their allocated territory. Successful execution of such a provision stops all direct competition at the source, for patents have been taken out in the principal countries of the world. This does not mean, of course, that Fiberglas is without any competition in the market, for there are substitute products.[27] But because of the limited number of substitutes, and because potential competitors are denied free entrance to the field by the existence of a fairly comprehensive patent structure, a condition of monopolistic competition prevails in the various market areas.

Patent pools and cross licenses are the basis of a number of important international agreements. It is reported that in 1904 the American Union Electric Company had entered into an agreement with the German General Electric Company for an exchange of patent rights. In 1911 three large makers—Siemens and Halske, the A. E. G., and the German Incandescent Gas-

[26] TNEC 2, pp. 658 ff. Testimony of Charles B. Belknap.

[27] Basically, Fiberglas is a very fine glass thread. It is used for making special purpose fabrics and especially for insulation.

burner Company—formed the Drahtkonzern, or Filament Trust. This was a patent pool by which rights under patents were exchanged. In 1912 the British lamp manufacturers entered into an agreement with this organization for the mutual use of patents in Great Britain. In 1912 and 1913 similar agreements were entered into between important companies in France, Holland and Austria-Hungary and the German companies. In 1921 a group of German and Central European lamp manufacturers, in combination with a Dutch company and a Swedish company and later the American General Electric and the Osram Company entered into a cross license contract for the exchange of patent rights. In 1924 there was an international agreement including all countries except Canada and the United States, by which there was an interchange of patents and research results between a large number of electric lamp companies. In 1932 an international agreement was reported by the Imperial Chemical Industries, the I. G. Farbenindustrie A.-G., of Germany, the National French and three Swiss companies, by which there was an interchange of research information and patent rights. Similar arrangements have been reported by the American concerns and companies in England, Germany and France, the basis of which has been the exchange of patent rights by way of cross licenses. There have been a large number of combinations of this character in the metallurgical, chemical, paper, and electrical industries.[28]

Enough cases have been cited to establish the existence of agreements between business organizations in different countries, and to point out some of the reasons why they are sought. It is not contended that these are the only reasons behind such agreements. They are the reasons that are announced to the public. Many times the agreement is merely a means of effecting the international cartelization of the industry. Cartels ". . . bob up especially in those lines of enterprise which require advanced machine technology and heavy investment in plant and equipment. They crop up

[28] Toulmin, "Patent Pools and Cross Licenses," pp. 151–52.

wherever patents or market outlets or mineral deposits are concentrated in few hands. . . . Cartels are a manifestation of oligopoly, or in rare instances oligopsony." [29]

The essence of the cartel system is agreement among independent producers, voluntarily arrived at. Agreements of this sort are prohibited within the United States by the antitrust laws. The antitrust laws do not, however, prevent American firms from entering into agreements with foreign producers.[30] Foreign patents owned by American firms constitute a valuable bargaining element in the determination of the terms of these international agreements.

The division and allocation of international markets tend to restrict competition within any given area. If foreign producers, by agreement, are excluded from the American market, the domestic producers are free to exploit it as they see fit. High prices in the United States do not bring about the importation of goods from abroad. International agreements of this sort serve to tie down the safety valve that would otherwise protect American consumers from exploitation.

International patent agreements—World War II. The results of the international cartelization of business take on added significance during war, for at such times the relationships between nations and their nationals are viewed in the light of the existing alignment of powers. Facts disclosed during World War II provide numerous illustrations of the role that patents play in effecting international cartels. Little would be gained by further documenting the tendencies that already have been indicated, but the conflicts of busi-

[29] TNEC 25, p. 13038. Testimony of Dr. Theodore J. Kreps. Oligopoly means few sellers; oligopsony means few buyers.

[30] It should be noted, however, that such agreements contravene the antitrust laws if they result in any restraints upon trade within the United States.

ness and national interest that result from international cartels based upon patents have received such wide publicity as to warrant consideration.

The use of patents to obtain nationalistic advantages for war purposes was an issue in the synthetic rubber controversy of 1942, which became a matter of great individual and national concern when the Japanese gained their early military successes in the natural rubber-producing regions of the Western Pacific. The controversy was closely linked with agreements that provided for the interchange of patents relating to synthetic rubber between an American organization, the Standard Oil Company (New Jersey) and its subsidiaries, and the I. G. Farbenindustrie of Germany.

Synthetic rubber takes several forms. While some of the synthetic rubbers are useful for specialty purposes only, two types were recognized in 1942 as suitable for tire construction. These were Buna-S, an I. G. Farbenindustrie development, and Butyl, a Standard Oil product. Prior to World War II, there had been many conflicting statements and claims with respect to synthetic rubber and its use for automobile tires. There is little doubt, however, that before the United States entered World War II, it was already technically possible and economically feasible to use synthetic rubber for tire construction.

The German government recognized at an early date that Germany would be shut off from supplies of natural rubber in time of war and it encouraged the development of synthetic rubber. Among other things it directed that the known processes be pooled and that information concerning such processes be withheld from dissemination abroad. In this atmosphere the German manufacturers proceeded to develop Buna rubber and to utilize it in tire construction. Permission

to divulge the technique of making Buna tires was never granted by the German government.

Butyl rubber is an American development and its application to tire construction was completely worked out in the United States. In 1940 Standard Oil gave the Firestone Tire and Rubber Company and the U.S. Rubber Company small amounts of several different types of Butyl rubber. After early problems had been worked out, tests indicated that improved types of Butyl could be made into tires comparing favorably with those made from natural rubber. For making inner tubes, Butyl was found to be superior to natural rubber.[31]

From information presented to the Senate Patents Committee, it appeared that both Buna rubber and Butyl rubber could be manufactured in the United States to sell at a price somewhat lower than the price of natural rubber. Whereas natural rubber sold for 20 to 22½ cents per pound, it was estimated that Buna-S could be manufactured at a cost of 17.6 cents per pound, allowing a 15 per cent return on the required investment. Butyl rubber, the American development, would cost but 8.23 cents per pound, including the same 15 per cent return on the required investment.[32] These cost estimates established fairly well the economic feasibility of using synthetic rubber for the motor vehicle tires necessary to the American transportation system.

Nevertheless, there was no sustained effort to get synthetic rubber into production until the shock of Pearl Harbor,

[31] *Hearings on S. 2303, A Bill to Provide for the Use of Patents in the Interest of National Defense or the Prosecution of the War, and for Other Purposes, etc.* Hearings before the Committee on Patents, United States Senate, 77th Congress, 2d Session, Government Printing Office (1942), part 6, p. 2748. Subsequently this series of hearings will be cited as S. 2303.

[32] *Ibid.*

which prompted the formation of a government-sponsored pool for its manufacture. Even then, Standard's Butyl rubber process was not made available for use until the Standard Oil Consent Decree on March 25, 1942,[33] which terminated an action by the Antitrust Division against Standard Oil and I. G. Farben.

The Antitrust Division's case alleged that these two firms and their subsidiaries and affiliates had entered into agreements that tended to restrain trade within the United States. Several of the agreements were built around the interchange of patent rights. Early contacts between the two organizations were firmly established in 1927 when Standard Oil paid I. G. Farben $20,000,000 for rights to various patents dealing with the hydrogenation process used in producing high quality gasoline. A subsequent agreement, known as "The Division of Fields" agreement, was entered into by the two companies on November 9, 1929.[34] In this latter agreement, the companies specified that they would not compete in each other's special fields. Standard Oil agreed not to engage in the chemical business unless it had some bearing on the oil business and, outside of the "German Area," I. G. agreed not to engage in the oil business. It was provided that should either party desire to initiate a development defined as falling within the other party's field, control including patent rights would be offered to the other party on fair and reasonable terms.

In 1930 the two parties further agreed to the joint development of certain fields in which they were commonly interested, provided the party other than the patent owner indicated that joint development would be desirable. This

[33] *Ibid.*, p. 2638.
[34] *Ibid.*, p. 2650.

was known as the Jasco agreement.[35] By its terms synthetic rubber should have become a matter for joint development. For several years Standard tried unsuccessfully to have the Buna process made a matter for such joint development and exploitation. If Standard had been successful, the Buna process would have been available in the United States before the outbreak of World War II. Standard was not successful, however, since the Hitler government would not permit the process to be disclosed outside of Germany.

In spite of its business agreements, I. G. Farben's actions were being forced along lines dictated by the nationalistic interests of the German government. When the Butyl process was developed in the Standard laboratories, the company officials felt bound by previous agreements to advise I. G. in order that I. G. might indicate whether or not the process should be developed and exploited jointly. In strict compliance with its agreements, and without the necessity of obtaining any clearance from the United States government, Standard agreed to turn over full information to I. G. concerning Butyl, and to furnish samples. In return, I. G. promised to try to get permission from the German government for similar disclosures to Standard Oil with respect to Buna.[36]

The evidence is not clear as to when the Buna process was finally released to Standard Oil, although it appears that the Buna patents that had been taken out in the United States came under Standard's control through the operation of the Hague agreement of September 25, 1939.[37] This agreement provided that all American, British, and French patents

[35] *Ibid.*, pp. 2879 ff.
[36] *Ibid.*, pp. 2666–67.
[37] *Ibid.*, pp. 2675–76.

owned by either Standard or I. G. would be exploited by Standard, and that I. G. would exploit both parties' patents throughout the rest of the world.[38] At the time of the Hague agreement, I. G. assigned some 2,000 patents to Standard Oil, this device being resorted to during the period of the war as a method of keeping alive and within the control of a trusted business affiliate the United States patents owned by I. G. Farben.[39]

After the Hague agreement and the accompanying transfer of patents, the two most important processes for producing synthetic rubber were controlled in the United States by Standard Oil through its title to the dominant patents.[40] Standard proceeded to develop and exploit its position in a manner that indicates a possible intention to obtain control of the rubber industry and motor transportation. As the international situation became more strained, however, the government was forced into a program intended to speed the production and utilization of synthetic rubber. That program was revised and expanded immediately after Pearl Harbor, at which time there was established a government-sponsored pool for making synthetic rubber. Standard withheld its Butyl process for this pool until the consent decree of March 25, 1942, which specified that the Buna and Butyl patents were to be made available royalty free during the period of the War Emergency, together with the "know-how" pertaining to their effective utilization. Standard was allowed to make a reasonable charge for the "know-how" relating to its Butyl patents, but could charge only actual

[38] *Ibid.*, pp. 2919–20.

[39] *Ibid.*, pp. 2638–39.

[40] There is some indication that there were patents held by other companies which might have jeopardized any domination of the synthetic rubber field attempted by Standard. Only the courts can determine the validity or scope of a patent, however, and none of the parties at interest elected to seek such a determination.

costs for the "know-how" of the Buna process which had been developed in Germany.

In some quarters, these facts were interpreted as a reflection upon the corporate character of Standard Oil and the individual integrity of its officers. It is alleged that the company played into the hands of the German government and neglected the interests of the United States. But a more liberal interpretation is that the synthetic rubber difficulty was a result of "business as usual," reflecting the attitude of the American people toward the European war before the United States entered the conflict. Business policy in general had not yet been converted to attainment of the objectives of a nationalistic war economy.

Two other cases can be cited in which international patent agreements between American and German firms interfered with war production. One involved a cutting material known as Carboloy (cemented tungsten carbide), which is used by the machine-tool industry. Cemented tungsten carbide had been known for many years, but not until the 1920's was it developed into a satisfactory metal-cutting agency. During 1927 and 1928, American industry imported the material from Fried, Krupp Aktiengesellschaft in Germany and obtained supplies from domestic concerns operating under American patents owned by Krupp.

General Electric owned American patents for producing this material. Instead of using its patents independently of Krupp,[41] General Electric worked out an agreement with Krupp in 1928 whereby G-E was to receive control over all the American patents and become the agency determining domestic sale and resale prices for the material.[42] A 1936

[41] There is some indication that the patents were completely independent and could have been used without coming in conflict with the Krupp patents. S. 2303, part 1, p. 52.

[42] *Ibid.*, pp. 281 ff.

revision of the agreement gave Krupp the right to veto any additional licenses that General Electric might propose to grant to American firms.[43] Since Krupp agreed not to export to the United States, General Electric obtained absolute control over all sources of the material in the United States. In return, General Electric was not to export from this country. As further consideration for being allowed complete control over the domestic market, General Electric agreed to pay royalties to Krupp, these royalties to be based upon the total American production of the material.

Several allegations have been made from a disclosure of the facts in this case. First, Germany was able to gauge the extent of the American machine-tool industry and munitions production from the size of the royalty payment made by General Electric. Second, since German interests could veto additional licenses proposed by General Electric for American producers, Germany could control the production of a necessary material for munitions production.[44]

Another important case involved an agreement between the Remington Arms Company and subsidiaries of I. G. Farbenindustrie in respect to tetracene, an improved material for making cartridge primers for small arms ammunition. The tetracene primer mixture was invented in Germany during the early 1920's and patented in leading nations including the United States. In 1929 the Germans made an outright sale of the American patent to Remington. The consideration was $25,000 plus a continuing royalty on sales.[45] In the purchase agreement with the German interests, Remington committed itself to sell no military ammunition with tetracene primers outside the United States,

[43] *Ibid.*, pp. 288 ff.
[44] There is no evidence that this did happen.
[45] S. 2303, part 1, pp. 569 ff.

and to sell only limited quantities of tetracene primed non-military ammunition abroad.

The provision regarding foreign sales of tetracene primed ammunition was, on its face, merely a recognition of the patents that existed in foreign countries, but the effects were much broader since under subsequent agreements Remington obtained the right to sell tetracene primed ammunition within the areas covered by the British and Canadian patents. The true situation became apparent in 1941 when the company was shipping tetracene primed small arms ammunition to Britain. Upon realizing that its agreement with the German interests carried a prohibition against such foreign sales, Remington substituted less satisfactory fulminate of mercury primers in order to complete its contract.[46] Through the operation of the agreement, the Germans were able to obtain information as to the amount of ammunition sold to the American government (up to the time the United States entered the war) by means of the reports required of Remington, the right to inspect the company's books, and by a computation of percentage to royalties. The royalty provisions introduced a peculiar angle to the case since, being permitted royalties on all tetracene primed ammunition sold by Remington, the German interests even benefited from that sold to the United States government for use against Germany.[47] (Royalties paid during a war period would be held by the Alien Property Custodian for delivery to the German government after the war.)

To some, these disclosures mean that American business interests betrayed the nation. The facts indicate, however, that American business organizations, intent upon entrenching themselves in the domestic market, entered into agree-

[46] *Ibid.*, p. 529.
[47] *Ibid.*, p. 524.

ments favorable from their own points of view, but not duly considered from the viewpoint of the national interest. Many such agreements were designed specifically to eliminate foreign producers from American markets. Such agreements were effective to this end, but failed in other respects. They covered only the business problems of the participating American firms. If they benefited the German national interest, it is probably a result of the effective nationalistic policy of Germany with respect to such agreements. War production problems indicate the need for such a policy in the United States, not an accusation of treason or betrayal.

The facts of the three cases that have been summarized are strikingly similar. They indicate two things. First, large American business organizations actively sought a dominant position in the domestic market with little regard for the interests of consumers. Business interests did not view the antitrust laws as a deterrent to agreements with foreign competitors, and the Antitrust Division was tardy in considering these agreements as restraints upon trade. Second, the United States government had established no guiding policy with respect to agreements that private interests in this country made with private interests in foreign countries. This resulted in many "private" international agreements, conflicting among themselves and, more important, conflicting with the national interest.[48] The conflicts are most evident during war periods. In a world troubled by recurrent wars, peaceful nations must anticipate and prepare for battle, but the facts indicate that the United States had no adequate provision for protecting its national interests from the operations of foreign countries working through their business nationals.

The situations that developed prior to World War II need

[48] No effort is made here to consider other than patent agreements.

not be considered as a reflection upon the American companies who were parties to agreements with firms under the jurisdiction of the Hitler government. The German firms participating in the agreements were not free agents, but to a considerable degree were functioning under the direction of the German government in the accomplishment of industrial espionage and sabotage. The control exercised over the foreign relations of German business organizations is in marked contrast to the complete freedom from supervision that characterized the business operations of American firms.

Some measure of control over international patent agreements might well be adopted by the American government. A simple method of coping with the problem is to refuse foreigners the privilege of patenting their inventions in the United States. But clearly it would be undesirable for the United States to deny itself the benefits of foreign ingenuity.[49] China grants no patents to foreigners, which probably is a factor in that nation's limited industrial development.

Another possibility is that the United States, while granting patents to foreign inventors, might prohibit such patents from becoming the subject of agreements or licensing. Such a policy would be little better than outright refusal to issue patents to foreigners, since foreign inventors seldom can come to this country to develop and exploit their American patents. The only practical way for them to realize a return from their inventive efforts, so far as an American patent is concerned, is for them to trade off the patent rights granted by the United States government. This trading may take any one of several forms, but most likely it results in cross-licensing agreements between some American firm and a

[49] It should be recalled in this connection that German inventors take out more patents in the United States, on the average, than American inventors take out in Germany.

foreign firm. To deny the privilege of such trading would, in effect, remove the incentive for seeking American patents, with the same result as denying the issue of patents to foreign inventors.

Considerable control over patents could be obtained if the parties to "private" international agreements were required to file such agreements with an appropriate government agency, such as the State Department. The United States would thereby have at hand at all times full information concerning such agreements, and machinery could be established to take such action as developments might indicate to be necessary. The government would, in effect, be in a position to police the international dealings of its nationals. If the government followed a purely passive role this device would be quite ineffective.

Perhaps the best way to assure the protection of the national interest is for the government to be made a party to all "private" international agreements. Responsibility for preventing provisions contrary to the public interest would then rest directly on the government. Because of administrative difficulties in making the government a party to agreements, however, the suggestion for filing of "private" international agreements is perhaps the most practicable. With the various agreements on file, the directing agency of the government would be able to keep them under constant review, interpreting them in keeping with the development of world events. When the current situation indicated that a particular agreement might be turned to the disadvantage of the nation, the agency would be in a position to make immediate recommendations to the American company involved as to the proper action to be taken or the possibilities that should be guarded against.

If, however, American diplomacy is attempting to ap-

pease nationalistic, militaristic foreign nations at the same time efforts are being made to build up the national defenses or the national striking power, a fundamental difficulty arises. The government would have to choose between the use of patent favors to maintain peace and their use to achieve maximum military strength. In the months preceding World War II appeasement failed miserably and military strength was sacrificed. But there is no device that will guarantee effective use of patents for war needs if the government is not disposed to make such use. At the very least, it would be an advantage to have the various positions a matter of public record in order to provide information upon which the government could take immediate action once the period for vacillating action—for appeasement—was past.

CHAPTER XII

PATENTS AND THE PUBLIC INTEREST

IF THE patent system promotes the public interest, it should be retained; if the patent system does not promote the public interest, it should be done away with or modified so that it will effect the desired ends. The patent system can promote the public interest by promoting "the progress of science and useful arts." This may take the form of a greater diversity of products, or more efficient methods of obtaining already known products, or both. If the patent system produces these results, it is in the public interest.

The possibility of obtaining the right to exploit a new invention as a monopoly encourages the development of novel ideas and their application to industry. The process of innovation is accelerated. This is one reason for the patent system, and it will justify the monopoly grant if the gains from the early introduction of the invention are not completely offset by the social losses inherent in monopoly.

Monopoly and regulation. The public interest demands that the maximum amount of consumable goods and services be made available to the public at the lowest possible cost. The problem is more than a production problem; the institutions of society must be those which will effect an equitable distribution of the produced goods and services. Freedom of enterprise and competition, taken together, have

been relied upon to assure the production of the desired goods and services and to secure their equitable distribution.

Freedom of enterprise, however, does not guarantee competition. To meet this situation the Federal Trade Commission and the Antitrust Division of the Department of Justice have been charged with maintaining competition in American business. Their task is an ever-growing one. In the late 1930's and early 1940's the government engaged in one of the greatest "trust-busting" campaigns in history, but there is little reason to believe that campaign reversed the trend toward large-scale operations and concentration of control, with the accompanying monopoly elements.

The word "monopoly" is a broad term that refers to dominance in general. The means by which a dominant position is attained are too seldom considered. There are two methods whereby a firm may come to dominate a field of activity. Monopolies may be founded upon either *restriction* or *efficiency*. Government policy should recognize these two types of monopoly.

The traditional antitrust policy is the proper one for dealing with monopolies that are founded on restriction of output and unfair trade practices. The restoration and maintenance of competition tend to assure that prices will be closely related to costs, that output will be maximized, and that employment will be maintained at a high level.

Monopolies based upon efficiency should be treated differently. Monopoly is the logical outcome of competition when large-scale operations result in lower unit cost. It is not in the public interest to enforce competition under such circumstances. The public interest is served best by encouraging expansion and concentration, and regulating the resultant monopoly to assure that the economies are passed on to consumers.

Many inventions improve the efficiency of the productive process. They give the owner of the patent an advantage in competition, and may make it possible for him to drive competing firms out of business and to monopolize the field. The logical development of the traditional antitrust policy requires that such a monopoly be dissolved; but the public interest would be better served by allowing it to continue, subject to regulation which guarantees that economies will be passed on to the public in the form of lower prices and a greater quantity of the product. The suggestion of regulating patent monopolies raises two fundamental questions. If the prospect for profits above the normal were removed, would inventors have adequate incentive to develop new ideas that result in greater efficiency? Furthermore, would businessmen undertake the exploitation of new inventions if they were denied the possibility of more than the normal rate of return?

Once a business is established, it is doubtful if the prospect of abnormal profits is necessary for a proper stimulus to inventors and businessmen. This is especially true if there are unused productive factors available. So long as there are unused factors seeking employment, any undertaking that holds the prospect of even the normal return should not lack backers. Something less than the usual return will suffice for some enterprisers, and it is through the activities of these people that the demand for and supply of the factors of production are brought back toward equilibrium.

Regulating monopolies and putting a limit upon profits need not unduly interfere with the adoption of efficiency-promoting inventions. Cost-reducing inventions are utilized to counteract forces that would otherwise result in losses. Cost-reducing inventions are quite generally resorted to dur-

ing depressions and periods of falling prices, such as the early 1930's.

Radically new, untried inventions are usually introduced during periods of rising prices. For new undertakings, the possibility of abnormal profits is necessary to offset the chance of large losses. Profit possibilities are always greater during periods of rising prices, so the really new developments are introduced at that time. A truly basic invention is so different from existing goods or processes that few established firms care to undertake its exploitation. New enterprises are required, and these new enterprises will be undertaken so long as there is freedom of enterprise and the prospect for profit.

The necessity of establishing a market for a new development is usually sufficient to keep new enterprises from exploiting the public. It is often necessary to sell below cost during the introduction of the product.[1] Regulation is unnecessary at that time. Regulation becomes necessary only after an undertaking establishes itself sufficiently well to be in a position to exploit the public. At that time it should be determined whether forced competition or regulated monopoly will best serve the public interest. Once the decision is reached, the full forces of the government should be brought to bear to assure the public of the maximum output of the product at the lowest possible price.

Provision for the regulation of patent monopolies in the way advocated here should be made in the government's general monopoly policy, rather than by amending or modifying the patent laws. Basic changes in the patent laws are neither desirable nor necessary. They are undesirable be-

[1] See TNEC 5, pp. 2096 ff., for testimony concerning the introduction of beryllium copper.

cause any reduction of the patent grant would tend to have an adverse effect upon inventive activity. Changes in the patent laws are unnecessary because the offending practices are really against the public interest, which the government monopoly policy should protect. If the monopoly policy does not adequately protect the public interest, it should be modified so that it will assure the desired results.

In many cases, the needs of society could be better served by insisting upon large scale units and greater concentration of control subject to adequate regulation, for big firms can often produce and sell the patented product at lower prices than the patent owner operating on a small scale.[2] Patents, however, make it possible for the small manufacturer to remain in business in spite of the fact that big firms, producing imperfect substitutes, sell their substitute products at lower prices. In this way patents promote competition; at least they result in monopolistic competition, with prices higher than competitive prices and profits not much greater than competitive profits.

Although a good case can be made for large-scale operations and concentration of control, subject to adequate governmental regulation, it should not be presumed that such a program would be applicable to every situation. In some fields the public interest is best served by many relatively small business units actively competing against one another. This is especially true where an industry operates according to the principle of increasing cost. The vigorous enforcement of the antitrust laws can help to promote the public interest in these cases. The antitrust laws may need to be supplemented, however, where patents are used to effect concentration.

[2] See H. R. 9259, pp. 74-86, for testimony in respect to the oil well supply business.

Abuses of the patent monopoly. The use of patents to establish a concentration of economic control is one of several ways in which the patent monopoly is abused. When large numbers of patents are owned by a single firm, the power of that firm in the business world is greatly enhanced. This position may be attained by purchasing patents outright from independent inventors, by developing inventions in the firm's own research laboratories, or by entering into cross-licensing or patent-pooling agreements with other interests. Regardless of the method used to bring together a plurality of patents, however, the total influence of the firm is likely to be greater than the total influence that could be exerted if the several patents were separately owned by competing interests. When a single firm controls a large number of patents, elements of monopoly not contemplated in the patent grant are found to exist.

The nonuse, or suppression, of patents is sometimes alleged to be an abuse of the patent monopoly. Those who hold this view agree that it is in the public interest to entrust the inventor with the exclusive right to exploit his invention, but they argue that failure to work the invention is a breach of the trust. It is held that mere disclosure of the invention is not enough to compensate the public for the seventeen-year period of exclusive use—that the same invention would usually be made and exploited by someone else if the patent monopoly did not exist.

There is a third way in which the monopoly granted by letters patent may be abused. Patents may be used to scare away competition. "Shot-gun" patents are used for threatening competitors with litigation. Threatened litigation can be as effective a weapon as actual suit for infringement in many cases, and it is much less expensive. Big companies, known to own a large number of patents and to be able to

finance extensive court proceedings, can use this device with considerable effect. "Scare-crow" patents have a similar use. The immense patent structures of giant business enterprises are a constant worry to potential competitors and may be the determining factor in their decision not to risk the venture. Many "shot-gun" and "scare-crow" patents are useless for any purpose other than frightening away competition. Their use for this purpose is clearly an abuse of the patent grant.

Recognition of the ways in which the patent monopoly is abused is but part of the problem. Attention must be given to methods that will eliminate the abuses. Numerous remedies have been suggested. These will be considered in the following order:

1. Taxing patents as a means of combating the concentration of economic control
2. The elimination of useless patents
3. The compulsory working and licensing of patents

1. Monopolistic patent structures can be built up by the purchase of patents taken out by independent inventors. This practice could be discouraged by levying a tax upon the purchaser or assignee every time the ownership of a patent changed hands. The tax should be large enough to prevent the accumulation of "scare-crow" and "shot-gun" patents, but not so large as to keep a manufacturer from acquiring the right to use those inventions that are essential to his business.

Similar results could be achieved by levying a progressive tax upon all owners of a plurality of patents, the tax increasing with the number of patents in the group. This would tend to make it unprofitable to build up a structure of "shot-

gun" and "scare-crow" patents either by outside purchase or through the activities of a research department. It would also tend to make it unprofitable to "fence-in" a field of development. Patents on alternative devices would then be available to competitors. If taxes had been levied upon all the patents owned by the Hartford-Empire Company, it might have been unprofitable for H-E to obtain the patents covering all the possible methods of producing glass containers by machinery. An avenue would have been left open by which competitors could have entered the field.

2. Numerous suggestions have been made for eliminating useless patents, such as levying an annual tax upon all patents or providing for a refund of part of the original fees if the patent were surrendered within a specified period after it was issued. It is presumed that the suggested tax would be paid only if the patent were actually of value or expected to be valuable. Otherwise the patent would be surrendered to avoid payment of the tax. The same result might be obtained by the refund of part of the fees, but the incentive for surrendering the patent would be much less, for the amount of the refund would be quite inconsequential.

There is merit to any proposal that would eliminate worthless patents. There are many paper patents which prevent the development of other inventions because of conflicting claims. Progress would be facilitated if the paper patents were eliminated. If it is necessary to wait seventeen years for the paper patent to expire, the patent on the workable invention would have expired also. The absence of patent protection reduces the prospect for speculative profits because there is nothing to prevent the immediate entrance of competitors. With less prospect of speculative profits it might be impossible to attract speculative capital for the

development of the invention. Or it might be that the workable invention would be out-of-date, or would have been superseded, by the time the paper patent had expired.

It should be held in mind, however, that any tax upon patents subtracts from the patent monopoly. The incentive to invent is reduced, insofar as inventions are made in response to the prospect of a financial return. A tax upon patents might reduce the sum total of new inventions. The real solution to the problem of paper patents, "scare-crow" and "shot-gun" patents, appears to lie in the direction of raising the standards of invention and patentability. Fewer worthless patents would be issued if the Patent Office insisted upon a greater degree of novelty—a higher standard of invention. This would meet the problem at its source.

When it is suggested that the Patent Office issue fewer patents, it is objected that the Patent Office has no way of knowing what will subsequently prove to be valuable, and in order to be fair to everyone it must issue patents even when the novelty of the alleged invention is open to serious question. This appears to be mere rationalization. If everyone were held to the same high standard, and the courts (which actually have the final word as to whether a patent must be issued) agreed to that standard, there would be no just cause for complaint. Furthermore, any invention that is subsequently to prove of real value should be sufficiently novel that there would be no question as to its patentability. The real solution of many of the problems that exist in relation to the patent system is to be found in the insistence upon a higher standard of patentability.

3. There has been considerable agitation in favor of compulsory working and licensing of American patents. Other countries have used compulsory working laws to promote domestic industrial activity by forcing foreign patentees to

work their inventions within the country or surrender the exclusive rights to the invention. This may mean that production has to be carried on in a high-cost country rather than in a low-cost country. Given a free choice in the matter, the patentee would prefer to exploit his invention in that country where costs of production are lowest. This might make it possible for consumers to obtain the product at lower prices than if the patent were worked in their own country. Compulsory working laws, therefore, have an effect similar to protective tariffs, so far as prices to consumers are concerned. If, however, the government wishes to encourage home industry, the protective tariff is the preferred method. A protective tariff does not detract from the patent monopoly, and so the incentive for invention and the incentive for the exploitation of patented ideas are not reduced. In fact, a protective tariff may provide an added incentive, for it improves the prospect of successful operations by restricting competition from abroad.

The real purpose of American advocates of compulsory licensing laws is to strike a death blow at patent suppression and industrial concentration effected through patent consolidations. Suppressed patents are those which are not being worked. There are many valid economic reasons for not working a patent. The invention covered may be of no value. Better devices may be available. The invention may require collateral developments that have not yet been made. There may be no present market for the invention, although it is anticipated that there will be a demand for it in the future. Or the cost of obsolescence might outweigh the savings that are anticipated.

New inventions can be economically adopted only if the average total cost of production when the invention is utilized is less than the average variable cost of production when

it is not utilized. Individual inventions of less merit, although cost reducing, would not warrant stopping the productive process to introduce them. The fact that an invention is not utilized as soon as it is made does not mean that the public interest is inadequately protected. The patent owner promotes the public interest by following his own best interest in respect to cost, so long as competition is enforced or government regulation of monopolized areas assures that prices are related to costs. To insist upon compulsory working of all patents would not be in the public interest.

Compulsory licensing is sometimes suggested as a weapon to be used against the concentration of economic control that flows from patent consolidations. There are two ways in which pooling and cross-licensing of patents tend to introduce monopoly elements. First, cross licenses may make it possible for the licensees to use patents that otherwise could not be used because collateral developments are not available, or because conflicting claims of other patents expose the patent owners to infringement litigation. The several inventions can be put to use when these conditions are removed by cross-licensing. The participating patent owners might be able to command the market if the use of the inventions resulted in greater efficiency and lower costs. Once they dominate the market they are free to exploit it as they see fit. The use of the freed patents might also enable the participating patent owners to produce a differentiated product. The market for such a product would be set apart from the market for the general class of goods and could, therefore, be exploited with some degree of independence.

The cross-licensing of patents may introduce monopoly elements in a second way. Many cross-licensing agreements are of an exclusive nature, that is, the parties involved agree that the benefits of the license are not to be made available

to other manufacturers. The benefits are exclusively for the original parties to the agreement. Agreements of this sort often bring into existence exceedingly formidable patent structures which can be utilized to discourage competitors.[3] The parties to the agreement are then in a position to exploit the market to their own advantage with little concern for the public.

The exclusive nature of cross-licensing agreements is sometimes condemned as conducive to the growth of monopoly, and some contend that compulsory licensing is the proper method of combating the monopolistic tendencies adhering to patent consolidations. Those who take this position, however, ignore the benefits which flow from license agreements that free a line of development or make possible more efficient methods of production. Monopoly hunters are often blinded by the evils which they seek to rout in battle.

A rational approach to any problem requires a clear vision of its many ramifications. A comprehensive view of patent pooling and cross-licensing recognizes good results as well as evil. These good results could easily be destroyed by compulsory licensing. There would be no incentive for entering upon a cross-licensing agreement if the parties to the proposed agreement knew that as soon as it was effected any outsider might apply for and receive a license under the cross-licensed patents. Patents are valuable because they allow the owner to exclude others from using the inventions; but if anyone could obtain a compulsory license to use the invention the patent would offer no protection whatever. Compulsory licensing would reduce patent protection to naught.

[3] This appears to have been one result of the cross-license agreement between the Hartford-Empire Company and the Owens-Illinois Glass Company.

The proper method of dealing with cross-licensing agreements is to be found in the monopoly policy outlined above. Some monopolies—those in the public interest—should be encouraged and regulated; others should be condemned and competition enforced. Any cross-licensing agreement that results in greater efficiency, so that a larger quantity of goods *can* be produced and sold at a lower price, should be approved and subjected to such regulation as will assure the desired result. Any agreement that cannot be justified on the basis of efficiency should be condemned and competition enforced.

Fluctuations in the rate of invention. American inventive activity has just about kept pace with population growth since 1880. The number of patents issued per 10,000 residents has remained approximately the same since that date.[4] Prior to 1880 technological changes were being made at an increasingly rapid rate, if the decennial increase in the number of patents issued per 10,000 residents is a proper index. Since 1880, however, the number of patents issued per 10,000 residents has been more or less constant. It must not be concluded from these figures that technological development has come to a standstill. The most that can be said is that, so far as these figures are indicative, increasingly rapid innovation characterized American industrial activity prior to 1880, whereas since then industrial development has been maintained at a relatively high level, but not further intensified.

Attention is directed to another set of figures made available by the Patent Office. These purport to show that the number of patents issued per 100 technological workers has fallen continuously since 1870.[5] There was a drastic decrease

[4] TNEC 3, p. 1124. Material prepared by the United States Patent Office.
[5] *Ibid.*

between 1890 and 1900, and there have been further slight decreases since 1900. Because these figures are contrary to what would be expected, they demand explanation. The explanation is probably to be found in the definition of technological workers.[6] There are many who are classed as technological workers who are hardly that at all. There is little reason to believe that masons and plumbers, for example, are especially qualified to make inventions, yet they are included in the classification. There has been a relative increase in the number employed in occupations which are really nontechnical, while those actually employed as technicians have not increased their output of inventions. Consequently, the Patent Office's figures show a decrease in the number of patents issued per 100 "technological" workers. It is doubtful if any particular significance can be attached to these figures.

Some of the other figures released by the Patent Office are more significant and give one a basis for arriving at more valid conclusions. For example, the number of applications for patents and the number of patents issued vary from year to year.[7] It is found that patent applications decrease during periods of war and periods of depression. Thus there were 7,653 applications filed in 1860, but this figure was not equaled again until after the close of the Civil War. A similar condition prevailed during the Spanish-American War, World War I, and World War II. In 1916 there were 71,033

[6] "Technological workers include all designers, draftsmen, professional inventors, electricians, engineers (civil, mechanical, and electrical), surveyors, chemists, metallurgists; all workers engaged in mechanical pursuits, such as machine operators, foremen, repairmen, plumbers, contractors, masons—not including general office workers." *Ibid.*, p. 844.

[7] The number of applications fluctuates more widely than the number of patents that are issued. There are two reasons for this: first, the number of patents issued is much smaller than the number of applications; and second, the fact that it normally requires about three years for an application to result in a patent tends to smooth out the fluctuations.

applications filed, 70,373 in 1917, and only 59,615 in 1918. The number of applications jumped up to 80,400 in 1919, the first full year of peace.[8] The number of patent applications fell by approximately 15 per cent during the first year of American participation in World War II. Similar effects have been noted during war periods in England.[9]

The effect of depressions upon the number of patent applications is not always marked, but it is observable. The recent depression provides an especially clear illustration. In 1929 the number of patent applications reached 94,738, an all-time high. The number then fell year by year until 1933, when it was 60,633, and then began to increase again. In 1937 there were 72,592 applications for patents.

The explanation of these facts is pure surmise. Inventive activity, however, requires both time and money—time to develop an idea from a mental realization that something can or should be done into a product or process that will accomplish the desired end; and financial backing that makes it possible for the inventor to experiment with the several possible solutions to determine which will best meet the need. When nations are at war every effort must be directed toward meeting the problems that require immediate solution. There is no time to consider the problems that exist during more normal periods. War activities tend to absorb all the time available. During depressions many inventors are unable to obtain financial backing for their experiments. The period is characterized by the absence of venturesome capital, and a lack of capital is abortive of inventive activity. It is only during periods of peaceful prosperity that these two requisites for successful inventive activity exist in any degree

[8] TNEC 1, pp. 245–46.

[9] "Inventions Cut as Wars Rage," *New York Times*, September 10, 1939, Sec. II, p. 8.

of abundance, and in those years the number of applications for patents is greatest.

Effect of patents upon the economy. There are many inventions that would be made even though the government did not grant patent monopolies to inventors. Inventions that satisfy the desire for self-expression, reputation, or improvement, and those motivated by altruism and laziness are examples. The possibility of obtaining a financial return by exclusive exploitation of the invention is of minor consequence in these instances, for pecuniary motivation is lacking.

It has been shown above, however, that the desire for economic reward is the most important factor motivating inventors.[10] The possibility of obtaining the exclusive right to exploit an invention for a seventeen-year period gives an inventor added assurance that his efforts will be rewarded with a financial return. While it is true that the prospect of a patent monopoly is an added incentive for inventive activity, it does not follow that men who are motivated by the prospect of an economic reward would cease to invent if they could not obtain patents. Profit possibilities often exist apart from patent monopolies, and profits above the normal rate may appear at one time or another throughout competitive business. These abnormal profits appear intermittently, however, whereas a patent monopoly tends to offer the prospect of extra profits whenever a good invention is made. The patent system, therefore, tends to assure the continuous development of new ideas. Furthermore, the added prospect for profit presented by the patent monopoly tends to result in the bringing forth of new ideas at an earlier date. Finally, the patent system results in a greater total amount of invention—more people turn to inventing because the

[10] See Chapter II.

patent monopoly increases the possible returns. A summary statement of the effect of the patent system might be that it results in continuous invention, more invention, and earlier invention.

Recognizing the effect of the patent system upon invention, consider its effect upon the use and economy of resources: natural resources, human resources, and artificial resources. How does invention react upon the demand for and supply of these resources? Consider first the effect on the demand for and supply of natural resources.

One effect of the patent system is to increase the demand for natural resources as of any given time, because inventions are made at an earlier date and in greater numbers. To put these inventions into practice requires more raw materials. This tends to be true whether the invention is "factor-using" or "factor-saving." Basic factor-using inventions quite definitely have this effect; by their very nature they result in an expansion of the economy. Factor-saving or efficiency-producing inventions may or may not have the same effect. Because they are factor-saving, it would seem that there must be a smaller demand for resources, but the validity of this conclusion depends upon the elasticity of demand for the finished product. If reductions in cost and price result in the sale of a much larger quantity of the finished good, raw material requirements tend to be greater, even though a smaller amount of raw material goes into each unit of the finished product. If, however, the demand for the finished product is relatively inelastic, factor-saving inventions tend to reduce the demand for raw materials, for the increased sales at lower prices fail to offset the economy of raw materials.

Some new inventions may have a direct effect upon the production and use of raw materials. New methods of min-

ing and refining metallic ores, for example, may so reduce the prices of the metals that considerably larger quantities can be sold. Although this is not actually an increase in demand, except in the market sense, it does result in greater activity among the producers of raw materials and the processors of those materials.

There is an additional effect that new inventions may have upon the producers and users of raw materials. The scarcity of some materials, and their resultant high prices, may lead to inventions that make it possible to substitute plentiful resources for scarce resources. The scarcity and high price of tin, and the impossibility of making certain of adequate supplies, for example, has lead to a search for new methods of packing foodstuffs and new alloys for use in bearings. As the search proves successful, more plentiful materials are substituted for scarce materials. The demand for some materials increases, while the demand for others decreases.

The effect of the patent system upon the utilization of the nation's human resources is an interesting subject which can only be touched upon here. The effect of basic, factor-using and efficiency-promoting, factor-saving inventions upon human resources is similar to their effect upon natural resources. They tend to create an additional demand for labor, except those labor-saving inventions that cause technological unemployment. Here again, an elastic demand for the finished good tends to mitigate the effects of the displacement; but the perishable nature of labor, its immobility, and the fact that most laborers are dependent upon their weekly earnings, makes the problem much more serious.

Efficiency-promoting inventions can benefit labor if they are not forthcoming in excess, and if the benefits are passed on to labor. Because a given amount of labor can produce a

greater output, it may be possible for labor to enjoy a higher standard of living. This may be effected through having more goods to consume or by having more leisure in which to enjoy the fruits of one's labor.

The demand for and supply of capital, or artificial resources, has been greatly affected by the patent system. Most of the capital equipment used in the United States was originally introduced under the protection of a patent monopoly. The pre-eminent position that this country holds among the industrial nations of the world is partially explained by the extensive use of capital equipment in the form of automatic machinery, which in turn is attributable to the liberal American patent laws. The prospect of a patent monopoly has been a constant incentive to inventors to devise improved equipment, and the protection afforded from cutthroat competition has induced businessmen to adopt the new devices. The introduction of improved equipment has probably been speeded up in many cases by the possibility of applying part of the monopoly profits obtainable under the patent to amortize the obsolescence costs incurred by junking old, but still serviceable, machinery.

In many cases the demand for capital equipment is derived from the demand for patented products. The production of new consumers' goods requires additional capital goods and new capital goods. The manufacture of the consumers' goods might not be undertaken without patent protection. Consequently, a greater demand for capital is sometimes attributable in this way to the protection afforded by the patent system.

There is one effect of the patent system that has not been considered, although it has been noted above. The patent system tends to assure the continuity of invention, for the patent monopoly holds promise of more than average returns

for all good inventions. The prices and profits generally prevailing cannot be relied upon to provide a continuing motive for inventive activity, whereas the patent system tends to assure the inventor of sufficient return to warrant sustained activity. The fact that the patent system encourages a continuous flow of inventions, plus the fact that it results in a greater total of new inventions, all made at an earlier date, leads to the conclusion that the operation of the patent system results in change—*change*—CHANGE!

The patent system is an intensely dynamic factor in the American economy. The values brought into existence in response to it are forever upsetting equilibrium relationships that have been established. New products affect the demand for existing products. New processes of manufacture reduce costs and result in lower prices. Economy in the use of resources results in overcapacity and disjointed price relationships. These and many more are the effects of the operation of the patent system. Each can be treated in isolation and individual equilibriums determined, but the problems transcend the operations of any given firm or any given industry. They have ramifications throughout the economy. Some of the gains may be offset by losses, but this is the path of economic progress.

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