

CIRJE-F-288

**Kiichiro Toyoda and the Birth of the
Japanese Automobile Industry:
Reconsideration of Toyoda-Platt Agreement**

Kazuo Wada
The University of Tokyo

July 2004

CIRJE Discussion Papers can be downloaded without charge from:

<http://www.e.u-tokyo.ac.jp/cirje/research/03research02dp.html>

Discussion Papers are a series of manuscripts in their draft form. They are not intended for circulation or distribution except as indicated by the author. For that reason Discussion Papers may not be reproduced or distributed without the written consent of the author.

Kiichiro Toyoda and the Birth of the Japanese Automobile Industry: Reconsideration of Toyoda-Platt Agreement.*

Kazuo WADA

Faculty of Economics

University of Tokyo

Abstract

In discussion of the birth of the Japanese automobile industry, most researchers and journalists obviously talk about the Toyota Motor Corporation and the Toyoda-Platt Agreement. It has been widely asserted that the one million yen that was received as a result of the Agreement provided Kiichiro Toyoda with the means to begin doing research on the automobile. But the historical evidence does not support this legendary story, and in many ways contradicts it. This paper aims to set the historical record straight.

1. Is the legendary story correct?

Toyota Motor Corporation is now one of the most famous companies in Japan(see Fig.1 on the relationship of the companies appearing in this paper). One can find whole shelves of bookstores in Japan with books and magazines on Toyota. Many of them have recounted the legendary story on the birth of Toyota as follows:

- (1) Sakichi Toyoda (1867-1930), a great inventor of textile machinery in Japan, developed a non-stop shuttle change automatic loom, the Type G Toyoda automatic loom.
- (2) Sakichi Toyoda sold the license for producing the Type G Toyoda automatic loom to Platt Brothers & Co. in England.
- (3) Platt Brothers intentionally did not produce Type G looms because the company just wanted to keep the Type G out of the market. In addition, Platt Brothers wanted to re-negotiate the license contract in order to reduce the license fee.
- (4) On his deathbed, Sakichi Toyoda, furious about Platt Brothers' behavior, gave the license fee from Platt Brothers to his son, Kiichiro Toyoda (1894-1952), and directed him to establish a car manufacturing business. Kiichiro Toyoda, therefore, established the automobile manufacturing business in Japan because of the dying wish of his father, Sakichi .

This legendary story, now widely accepted, tells us that a dutiful son followed his ingenious father's advice, out of which emerged one of the greatest companies in the world. A few scholars, however, have been skeptical; one has characterized it as the "setting for a story that was a bit too much like the stuff of minstrel ballads" with its focus on this "dying wish of Sakichi".¹ In fact, the historical evidence does not support this legendary story, and in many ways contradicts it. Setting the historical record straight is important for understanding the conditions that supported the emergence in the 1930s of a company that would lead Japan's remarkable growth in the post-World War II era.

It has been widely asserted that the one million (1,000,000) yen that was received as a result of the Toyoda-Platt Agreement provided Kiichiro with the means to begin doing research on the automobile. In *The Biography of Sakichi Toyoda*,² a famous Japanese historian claimed:

The 100,000 pounds that were received on the basis of the Toyoda-Platt Agreement eventually provided Kiichiro with the motive to make the Toyota automobile after

he returned to Japan.The Taxation Office levied the huge tax because it assessed as the selling price of the patent rights the sum of 100,000 pounds stipulated in the Toyoda-Platt Agreement. The Toyoda side countered by showing the text of the contract and insisting that the money was to be paid in installments of 8,000 pounds every half-year (16,000 pounds a year) and thus levying a tax on the entire amount was unfair, but the Taxation Office refused to change its position that tax must be paid on the entire 100,000 pounds. Then the Toyoda side appealed to the Incomes Inquiry Committee, which decided that “the tax levy is in error,” and the higher Incomes Inquiry Committee (which is part of the Nagoya Taxation Supervisory Board) came down with a similar decision. . . . Finally in 1933 it instituted administrative litigation. In subsequent years its general director was changed four times, and after the war jurisdiction was transferred to the Supreme Court; all together, the case was heard more than twenty times, and in the end it was referred to mediation. Since the whole of the 100,000-pound fee (royalty) for use of the patent right had already been paid in full, the issue was resolved by the payment of about 500,000 yen in all, including 160,000 yen for income tax and the rest for prefectural, municipal, and other taxes.³

Though this was how it was finally resolved, Sakichi was so angry at the unreasonable manner of acting of the Taxation Office that he told Kiichiro, “Seeing that these 100,000 pounds are jinxed, you might as well use the money to study automobiles; after all, it’s the same as if we found it on the street. It’s a million yen that I figured we’d have to deposit in the bank anyway, so I guess you might as well use it to do groundwork for making automobiles.” Kiichiro, who had returned from his trip to the United States and Europe in March 1930, was extremely happy to be told this, and he immediately set up an automobile program in the Toyoda Automatic Loom Works factory that nobody knew about.⁴

The amount of money Toyoda received from Platt Brothers in 1930, however, was not one million yen but just 250,000 yen – an insufficient sum to carry out automobile-related research. It appears, moreover, that this sum was distributed among Toyoda employees to lift their morale. The financial condition of Toyoda Automatic Loom Works had been poor in 1930. The company had cut wages and dismissed 21 workers in the summer of 1930, resulting in a labor dispute. At the memorial service in February 1931, on the hundredth day following Sakichi’s death, 250,000 yen was distributed among about 6,000 employees in the Toyoda group as a special reward for past services. Of this sum, 100,000 yen was divided among the senior personnel who had worked directly with Sakichi in the course of his inventions, with the remaining 150,000 yen being allotted to the other employees in the group.⁵

The legendary story of the origins of Toyota is, therefore, unreliable. Indeed, to fully comprehend the conditions that made it possible for Kiichiro Toyoda to found Toyota Motor Company, and the role of the Toyoda-Platt Agreement, it is necessary to recognize the role of Kiichiro's own career in the 1920s, beginning with work experience at the factory of Platt Brothers in 1922, as well as the subsequent invention of the "Type G automatic loom", the patent rights of which were transferred to Platt Brothers.

2. Work experience at the Platt Brothers factory, and the birth of the "Type G Automatic Loom"

i) Work Experience at the Factory of Platt Brothers

Kiichiro Toyoda once boasted: "I feel confident that I take a back seat to nobody when it comes to looms."⁶ Most people usually regard Kiichiro as merely the founder of Toyota Motor Corporation. His statement, however, shows how much he prided himself on his abilities as a textile machine engineer, which was his real *métier*. In March 1938 Kiichiro received the Imperial Commemorative Award from the Imperial Academy of Inventions in recognition of his shuttle-change automatic loom (Patent No. 65156), the basic patent of the Type G automatic loom. This award was the highest honor a Japanese inventor could receive. His father, Sakichi Toyoda, had also received the same award from the same Academy in September 1926 for his invention of the automatic loom. Sakichi was the second person to receive the Imperial Commemorative Award; Kiichiro was the fourth.

Initially, at the beginning of Kiichiro's career, Sakichi had wanted his son to concentrate on the spinning business. So, after his graduation from the Department of Mechanical Engineering of the Faculty of Engineering of Tokyo Imperial University in 1920, Kiichiro entered his father's Toyoda Cotton Spinning and Weaving Co. (Toyoda Boshoku), which had been established in 1918. Only two of 48 graduates of the Department of Mechanical Engineering found employment in the textile industry, and one of them was Kiichiro.⁷

In April 1921, Kiichiro Toyoda began work at the Toyoda Cotton Spinning and Weaving Co. In July of that year, he left Japan on a trip, first, to the United States, and, then, to England. The original plan was for Kiichiro to "stay in England for one or two years",⁸ but he stayed there only about two weeks. During that time he went to Platt Brothers to understand the structure of textile machines. If he had stayed "in England for one or two

years” as originally envisaged, Kiichiro would have moved on to a cotton spinning mill in order to understand the operations of the spinning business.

But after visiting Platt Brothers of Oldham for about two weeks, Kiichiro was called back to Japan. Why did Kiichiro suddenly leave for Japan without staying “in England for one or two years”? One of the Toyoda group companies, Kikui Cotton Spinning and Weaving Co. (Kikui Boshoku), had a plan to set up a new plant, with operations scheduled to begin in June 1918. But World War I activities affected the production schedule of the American company, Whitin Machine Works, from which they had ordered the spinning machines, and so Kikui Cotton Spinning and Weaving Co.’s construction plans were seriously delayed. It would be July 1922 by the time the spinning machines arrived from the United States and were properly installed so that the company could begin operating in the new location.⁹ Whitin Machine Works sent some of its technicians to help install the machines and teach Japanese operators how to tend them. Thus it was that Kiichiro was able to learn from the American technicians not only how to handle the machines but also how to maintain control over and run an entire spinning mill.¹⁰ Therefore Kiichiro had no reason to stay in England. Kiichiro later wrote: “Fortunately, Westerners came and taught me [about the secrets of how to operate a spinning mill] very thoroughly for one whole year.”¹¹

During his short stay at Platt Brothers in Oldham, Kiichiro wrote about its operations in detail in his diary. Furthermore, Kiichiro’s diary contains a hand-written drawing that extends over seven pages of a design for a cop-change automatic loom. There are several other similar drawings as well, all of them of cop-change style looms. His father, Sakichi, had devoted all his energies to developing shuttle-change looms, but in Oldham Kiichiro was studying automatic looms that were different from those preferred by his father. Later Kiichiro wrote:

When we [Kiichiro and a few others] were still doing research on automatic looms I thought that [the cop-change method] was better, but my father, Sakichi Toyoda, was adamant in insisting that the shuttle-change method was better. He said he, too, had made two or three [of the cop-change automatic looms] and had experimented with them.¹²

ii) The Invention of the shuttle-change automatic loom

Sakichi Toyoda was a great inventor, and nobody had ever matched his contribution to the development of the loom in Japan. Yet there was one thing Sakichi deeply regretted. It

had to do with Toyoda Loom Co., which had been established to commercialize his inventions. Right from the beginning, the company had encountered problems, as its president, Fusazo Taniguchi, pointed out in the general meeting of shareholders held in April 1907:

Mr. Toyoda has added essential improvements to many different previous inventions, so that today the Toyoda loom is so advanced that I would not hesitate to claim that it is nearly as perfect as it can be in structure. Still, while it definitely has advanced, the equipment needed to produce this loom in its entirety is still lacking, a fact that is very regrettable.^{1 3}

Production of this loom did not proceed smoothly. The company had invited Charles A. Francis, an American instructor at Tokyo Higher Technical School (the present-day Tokyo Institute of Technology), to provide tools involved in the design of the loom that would ensure uniform standards and to achieve technical improvement and efficiency in the manufacture of loom. But Francis was unable “easily to correct the inexperience, oversights, and mistakes of the workers.”^{1 4} The company strove for mass production of products by using parts that were interchangeable, but it failed in this attempt. In Japan before the 1910s the techniques for producing castings and steel were not yet developed. The use of inferior materials made it difficult to produce precision, interchangeable parts.

Sakichi funneled all his efforts into working on the automatic shuttle changer, the key to an automatic loom that would be suitable for Japanese conditions. But Toyoda Loom Co. did not have enough spare funds available to funnel money into leading-edge inventions, and the very survival of the company stood in jeopardy. While Sakichi continued his mighty efforts to complete the automatic loom, one of the patented devices that seemed useless was Patent No. 17028, an “automatic shuttle changer” (patent applied for on 10 June 1909, registered in September 1909). In Sakichi’s long career as an inventor, this shuttle changer was a masterpiece that must have been among his proudest inventions. This device more than any other made it possible to produce a loom that both in name and in deed could be called an “automatic shuttle-changing” loom. Sakichi’s automatic shuttle changer had a two-stage motion. A smooth shuttle change was impossible if there was even a slight delay between the two motions. But it was extremely difficult to manufacture the device that precisely.^{1 5}

Yet when the research and development team headed by Rizo Suzuki, Risaburo Ohshima, and then Kiichiro aimed at developing an automatic loom, it was Sakichi’s automatic shuttle changer that was their starting point. Sakichi’s ideal automatic loom was one that would “sense” when a warp or weft yarn broke and would stop immediately, and if the shuttle was running out of yarn the machine would have, built into it, a device that would replace that shuttle with a new one. It was in order to develop this ideal machine that Sakichi had resolved to entrust research and development to Kiichiro and the others, while he supplied the

“bread” needed for such experiments by “renouncing the monastic life of the lab and working his head off.”^{1 6}

When the research team had thirty looms working in early 1920s, they decided they would have two hundred looms made and test-run them, but a situation they had not expected stopped them in their tracks. Their own company, Toyoda Cotton Spinning and Weaving Co., was not equipped to manufacture looms. It was a spinning and weaving company whose principal purpose was to do research on loom performance rather than on loom construction. Kiichiro and his team had been expecting to have the two hundred looms made instead by Toyoda Loom Co. In the past there had been friction between Sakichi and Toyoda Loom Co., but Kiichiro went ahead and put in a request for two hundred looms. But Toyoda Loom Co. refused to manufacture the looms, and furthermore the company stressed that it owned the patent rights because Sakichi had transferred the rights to the company several years earlier: the patent in question was Sakichi’s “automatic shuttle changer,” Patent No. 17028. The patent had been registered on 18 September 1909, so its fifteen-year term would soon be running out. If the patent period were extended, the automatic shuttle changer that had become operable thanks to the efforts of Kiichiro and his research team might never be put to practical commercial use.

Still, in the process of taking steps to enable Sakichi’s automatic shuttle changer to function properly, Kiichiro and his team had already ironed out the problems in Sakichi’s patent. Kiichiro and his team had made changes to the structure of the patented shuttle changer to prevent the occurrence of the slight delay between its two motions. Kiichiro writes about this in a very matter-of-fact way.

In this situation we did not panic. The reason was, in the course of our experimental manufacture of the thirty looms, various ideas came up and we tried different things, as a result of which we realized that the single-stage method of changing the shuttle that resulted from our new ideas was better than the two-stage shuttle changer of the old patent.^{1 7}

This newly devised patent was “a thing that was structurally absolutely simple, and it worked flawlessly.”^{1 8} It is not surprising that the *Forty-Year History* of Toyoda Automatic Loom Works would describe it in the following exultant terms.

The “shuttle-change automatic loom” registered as Patent No. 65156 was an epoch-making device that changed the shuttle smoothly even when running at high speed, without slowing down and without damaging the shuttle. When some years later technicians from Platt Brothers saw it in action they were awe-stricken and called it “the magic loom.” When the automatic shuttle changer and other

mechanisms were attached to the loom frames and tested, not a single fault was found; this marked the birth of the perfect automatic loom.¹⁹

The name of the person to whom the patent rights for the “shuttle-change automatic loom,” Patent No. 65156 (applied for on 25 November 1924, registered 10 August 1925) were conceded was none other than Kiichiro Toyoda. It was on this patent that Kiichiro received his commendation from the Imperial Academy of Inventions.

There is an epoch-making significance in the fact that “the perfect automatic loom” was born in the mid-1920s. At the beginning of the twentieth century a brief attempt was made to introduce the Northrop cop-change automatic loom into Japan. Because of, among other things, problems with the quality of yarn, use of the automatic loom did not spread. But the recession in 1920 led to moves toward industrial rationalization, and this was soon followed by heightened interest in machine automation. This was true in the spinning and weaving industry as well. The Type G automatic loom was born in the midst of a move to enhance efficiency by increasing the number of machines that could be tended by one operator.²⁰

iii) The Establishment of Toyoda Automatic Loom Works: Manufacturing of the “Type G Automatic Loom”

The prototype of the Type G automatic loom was completed during the summer and autumn of 1924. Probably in September, but at the latest by the middle of October, trial operations began and preparations were made to submit a patent application. Then the patent application was officially submitted on 25 November.

In 1924 Kiichiro went on a business trip to Shanghai with his family.²¹ Sakichi wanted Kiichiro to transfer all 1,008 ordinary looms that were in operation in Toyoda Boshoku’s main plant to the company’s Shanghai plant, and replace them with the newly perfected Type G automatic looms. Staking the company’s fortunes on this automatic loom, Toyoda Cotton Spinning and Weaving Co.’s planned to run the main plant as a weaving factory that would simultaneously function as a testing laboratory. After the financial panic that followed World War I, and the campaign for industrial rationalization, momentum was growing in the spinning industry to adopt automatic looms. If Toyoda’s experiment succeeded, they would be able to take woven-cloth manufacturers into the plant, and show them the Type G automatic looms working nonstop. The plan, in short, was to show the world the practicality of the Type G automatic loom.

The other side of the story was that the 1,008 ordinary looms from Toyoda Cotton Spinning and Weaving Co.'s plant would have to be adjusted once they were installed in the Shanghai plant. If it had been a matter of one or two looms there would have been no problem, but when over one thousand looms would need adjusting, every expert hand was needed. There would be some damage incurred during transport. There would be differences in temperature and humidity between Shanghai and Nagoya. There would be differences in the quality of the cotton yarn. All these factors would require a great deal of tinkering with the looms before they would be running smoothly again. In order to carry out this task, Kiichiro went over to Shanghai. Kiichiro was resigned to a long stay in Shanghai, and therefore he began to study Chinese.^{2 2}

But Kiichiro was barely settled in Shanghai before he received instructions to return to Japan with his family. After a stay in Shanghai of almost three months, Kiichiro returned to Nagoya in December 1924 to be involved with the establishment of Toyoda Automatic Loom Works.

Originally, as we have seen, Sakichi and Risaburo's plan was to transfer the 1,008 ordinary looms located in the Toyoda Cotton Spinning and Weaving Co.'s main plant to the Shanghai plant, and install the new Type G automatic looms in their place in the main plant, where experimentation would occur. To carry out this plan, Toyoda Cotton Spinning and Weaving Co. would need a thousand or so new Type G automatic looms. The company did not, however, have equipment for building machines, so it placed an order for 1,008 loom frames with Toyoda Loom Co. (the same company with which there had been troubles over the ownership of Sakichi's patented automatic shuttle-change device). The latter turned down the order for loom frames. As a result, Toyoda Cotton Spinning and Weaving Co. was forced to change its original plans. It called off the plan to transfer looms to the plant in Shanghai. Sakichi went to an acquaintance of his, one Sakuzo Nozue, and leased an iron works Nozue owned in Hioki-cho in Nagoya. Obtaining the cooperation of Chotaro Kubota (a man who had once been in charge of loom casting under Sakichi and had started up his own casting factory), Sakichi decided to have foundry equipment made so Toyoda Cotton Spinning and Weaving Co. could manufacture automatic looms itself.

The impact of the sudden change in circumstances went beyond the now aborted plan to transfer looms to Shanghai. Since a factory for manufacturing looms would now be needed, a decision was made to purchase land near the Kariya experimental factory and build on it a factory for the full production of automatic looms. This shift in strategy, so important from a managerial perspective, meant that there no longer was any reason for Kiichiro to be in Shanghai. On the contrary, now Kiichiro was needed for the construction of the new factory, he had to make a hasty return to Japan.

Why did the Toyoda Cotton Spinning and Weaving Co. try to place an order for 1,008 loom frames? As the experimental manufacturing of a prototype Type G loom progressed,

the company decided to make a major change in the way it would manufacture and market Type G looms. The original plan was to sell the automatic shuttle changer as a separate unit that the purchaser would attach to an ordinary loom. The new plan was to incorporate the automatic shuttle changer in a completely new loom. Kiichiro explains why:

We attached the automatic loom part to 200 new ordinary looms and tried them out in the Kariya plant. It was a disaster. In hindsight, it sounds a stupid thing to do. At the time, though, we went to a lot of trouble to adjust the automatic looms, and when unexpected breakdowns occurred and things somehow just wouldn't work well, we felt as if the automatic looms were possessed by the Devil. Before we had installed the 200 looms we had tested 30 of them fully and were sure we had ironed out all problems, but then when we went ahead and installed 200, and the above problems kept occurring; we sometimes were ready to give up altogether. From this bitter experience we became convinced that it was absolutely impossible to attach this automatic part to earlier ordinary looms, especially the older ones.^{2 3}

This unsuccessful experiment in attaching automatic shuttle changers that require precise action to ordinary looms that were not made with very high precision made Kiichiro for the first time conscious of an important concept in manufacturing: "allowance," or "permissible margin of error". The problem he had to solve now was how to get a loom with the automatic shuttle changer attached to it to operate smoothly. The realistic solution was to manufacture an entire new loom into which the automatic shuttle changer would be incorporated, and then sell this new loom as a unit. Once everyone involved agreed to this course of action, the decision was made to entrust everything, from the designing of the equipment for manufacturing the entire loom to the building of the factory to hold the equipment, to Kiichiro. In the painstaking written documents that Kiichiro has left us, we see him striving to follow a detailed plan with the aim of beginning trial runs of the Type G automatic loom in the Kariya experimental factory by 1 September 1925.

Toyoda Cotton Spinning and Weaving Co. decided that it would build an additional 320 looms so that the Kariya experimental factory would have a total of 520. It would also send spinning yarn from its main plant in Nagoya to the experimental factory. It decided it would install Platt Brothers spinning machines with 20,000 spindles to go with the Type G automatic looms, so that the factory would be run as an integrated spinning and weaving plant. The outcome of operations in this experimental factory would have a major impact not only on the fate of the Type G automatic loom but also on the management of the entire Toyoda Cotton Spinning and Weaving Co. enterprise.

On the 25th of September 1925, Toyoda Cotton Spinning and Weaving Co. held a special general meeting of shareholders. At the meeting it was decided to increase its authorized

capital by 3,000,000 yen up to 8,000,000 yen, and to issue new 6,000 shares.^{2 4} By the 2nd of November 1925, thirty-five yen was paid up for each of the new shares.^{2 5} The company obtained 2,100,000 yen in order to finance the 20,000-spindle-capacity spinning machines for the Kariya experimental factory.

By the end of March 1926, Toyoda Cotton Spinning and Weaving Co. had installed a total of 520 Type G automatic looms and 20,000-spindle-capacity spinning machines in the Kariya experimental factory, and trial operations as a spinning and weaving company were begun in earnest. Thanks in part to its new spinning machines, “yarn of far better quality than even our main plant’s yarn was being spun, and the looms were running at top capacity after having been improved down to the smallest parts, so the result of the trials was absolutely ideal.”^{2 6}

Because the trial results were so good, it was decided to go ahead and build the factory to manufacture these automatic looms. The site would be on land that had been acquired to build accommodation for workers employed by the experimental factory. On 17 November 1926, a general meeting was held in the offices of Toyoda Cotton Spinning and Weaving Co.’s main plant to celebrate the founding of Toyoda Automatic Loom Works, and the Works was registered as a company the next day. Risaburo Toyoda was appointed the president of the company, and Kiichiro became the managing director. Kiichiro was only 32 at the time. Young as he was, he was handed responsibility for bringing the factory on line.

The challenge facing Toyoda Automatic Loom Works was to make and sell the Type G automatic loom, the first automatic loom with a nonstop shuttle changer. Toyoda Automatic Loom Works was positioned to take advantage of a big business opportunity, because of the rise in demand for automatic looms expected with the abolition of night labor, due in July 1929. Cotton industry companies were afraid that the abolition of night labor would mean fewer working hours and a drop in production efficiency. As a result, the question uppermost in their minds was whether the introduction of automatic looms into their plants would lead to a drop in production costs, even if it meant that they had to incur considerable initial investment costs. If the company was going to grasp this opportunity, however, the Type G automatic loom had to be economical and reliable.

The three largest cotton spinning companies, Toyo Spinning Co., Dai-Nippon Cotton Spinning Co., and Kanegafuchi Cotton Spinning Co. (Kanebo), had accumulated substantial internal reserves, partly as a result of the restrictions imposed on plant expansion during World War I. According to the president of Kanebo, Sanji Muto, abundant funds were available: “Among the spinning companies, Kanebo, Toyo, Dai-Nippon, and Godo [Osaka Godo Cotton Spinning Co.] alone had nearly 200,000,000 yen secretly salted away in banks.”^{2 7} In the light of circumstances such as these, it is clear that the cost of initial investment was not a big problem for the large spinning companies that also had weaving factories within their organizations.

Were the new automatic looms reliable? Would these nonstop-shuttle-change automatic looms, once manufactured, function properly when installed in the plants? Would the quality of the cloth woven by these automatic looms be inferior to that woven by ordinary looms? As the executive responsible for both manufacturing and sales, Kiichiro had to clear away as quickly as possible all these deep-set doubts and anxieties harbored by the potential clientele.

When people are worried and skeptical about the performance of a new machine, the easiest way to dispel their fears and doubts is to let them see it working with their own eyes. When the company began advertising the automatic loom, it invited customers to come and have a look for themselves. Not only were they “immediately swamped with inquiries,” but also “every day large numbers of visitors” came to the factory itself.^{2 8} After they inspected the factory where the looms were being built, the visitors were led to the other factory where the 520 looms were operating at high efficiency. The sight of the machines in action is said to have made a deep impression on the visitors. The fact that so many people came to visit the factories attested to the strong interest there was in automatic looms; it also showed the extent of their anxiety regarding whether the machines worked smoothly or not.

In the five months between the time sales of the new looms began in November 1926 and the end of March 1927, orders came in steadily for over 4,000 automatic looms.^{2 9} Apparently hoping to accelerate the pace of sales even more and at the same time clear away all doubts about the Type G automatic loom once and for all, Kiichiro decided to take the bold step of opening the Toyoda Cotton Spinning and Weaving Co.’s Kariya factory to select members of the public in one grand gesture. On 6 February 1927, a workshop for textile engineers was held. The attendees were invited to visit the factory, and they could also ask Kiichiro questions about the equipment or the machinery. Sakichi was also supposed to be there to give a talk on how the Toyoda automatic loom was invented, but it seems he did not do so on that day.^{3 0} Still, the workshop was a huge success, both for Kiichiro and for Toyoda Automatic Loom Works.

iv) Negotiations for Transferring Patent Rights

Although orders for automatic looms were coming in steadily, Kiichiro seems to have become increasingly concerned about the future. He was elated by the success of the Type G automatic loom. But his company had competitors. One was Enshu Loom, which had succeeded in developing the cop-change method with its smaller margin of error, and they claimed the machine was working. If they succeeded in mass-producing it, their loom would be a formidable rival for the Type G. Although Toyoda Automatic Loom Works scored an overwhelming victory over Enshu Loom through its early sales tactics, Enshu Loom later fought back, exhibiting its loom in exhibitions and shows in 1928, winning a few prizes, and

giving the automatic loom in general a good name. In 1929, emulating the open-house tactics employed at Toyoda's Kariya factories, it, too, opened its automatic loom factory so that visitors could see the looms in action. In 1929 Toyoda Automatic Loom Works shipped 4,004 looms to customers while Enshu Loom shipped 2,603.

Another company that was continuing to develop a shuttle-change automatic loom was Toyoda Loom Co. The trade journal, *Boshoku-kai*, mentions that "completion of a shuttle-change automatic loom by Toyoda Loom Co. is near," and it goes on to say that "a shuttle-change attachment being researched by Toyoda Loom Co. was finally completed and used experimentally at Hattori Spinning, Izumi Spinning, and other companies. The results were so good, Toyoda Loom Co. has decided to sell it in the general market. A contract for approximately 100 machines is reported to have been concluded with a certain factory on the outskirts of nearby Hamamatsu City." And towards the end of 1929, under the headline "Invention of New Automatic Loom: Huge Spur to Weaving World?," *Nagoya Newspaper* reported that Toyoda Loom Co. "has succeeded in producing a special automatic loom, and because the trial weaving was extremely successful, the company presently is producing considerable numbers in carefully kept secrecy." Thus we see that, although Toyoda Automatic Loom Works was one step ahead of the other companies, Kiichiro was still living in a fiercely competitive situation in which, no matter what he produced, similar products would soon appear on the market.

In such circumstances, Platt Brothers began to negotiate with Toyoda Automatic Loom Works for a transfer of the patent rights to the Type G loom. As the production of automatic looms grew more widespread in Japan and the manufacture of spinning machines began to flourish, Platt Brothers also began to make overtures regarding the establishment of a merged company in Japan. According to the company history of Toyoda Loom Co., talk of a merger emanated from Platt Brothers as early as 1920. Again in November 1928 Platt is reported to have suggested a "joint management plan" to Toyoda Automatic Loom Works. None of these negotiations bore any fruit. But even afterwards Platt Brothers continued to sound out, with Mitsui Bussan acting as their intermediary, the possibility of a merger with Toyoda Loom Co. and Toyoda Automatic Loom Works. In October 1929 the local *Nagoya Newspaper* opined that "it is safe to consider a merger [between the two Toyoda companies] only a matter of time now", with Platt Brothers joining them.^{3 1} But in the end neither a merger between Toyoda Loom Co. and Toyoda Automatic Loom Works nor a tie-up between Platt and these other two companies occurred.

Platt Brothers' continued negotiations with Toyoda Loom Co. and Toyoda Automatic Loom Works had a huge impact on the sale of the Type G looms. Apparently hearing good reports about members of the public being allowed to visit the Toyoda Boshoku Kariya factory, in April 1929 Mr. Chadderton of Platt Brothers personally visited Kariya to see the factory for himself.^{3 2} Two months later the *Nagoya Mainichi Newspaper* reported that, on

the June 7th, Mr. Chadderton had visited Toyoda Automatic Loom Works with a Mr. Dorman of the London Branch of Mitsui Bussan (this is the same Mr. Dorman who had arranged Kiichiro's hotel stays in England when he visited Platt Brothers in 1922), and that they had met with Kiichiro. The article conjectured that patent right transfers were discussed at that meeting.

We can also get some idea of the course of negotiations between Platt Brothers and Toyoda Automatic Loom Works from archival documents of the former. Chadderton reported the results of his visit to Japan at a meeting of that company's board of directors held on 21 August 1929. He explained that Toyoda Automatic Loom Works was proposing that Platt Brothers manufacture its automatic looms after payment of a fee for using its patents. The board of directors responded positively to the proposal and resolved to make up their minds after seeing the results of a trial run of the two automatic looms that Toyoda had sent them. But at the meeting of the board of directors held a week later, on the 28th of August, instead of deciding about whether to manufacture the Type G automatic loom or not, the discussion already centered on the question of the regions in which the company would have sales rights. Platt Brothers had clearly formed a high opinion of the Type G automatic loom. In the end, on 11 September 1929 the company formally approved a contract with Toyoda Automatic Loom Works covering a transfer of patent rights.

The spinning industry, which had generated such huge profits during World War I that Sakichi had urged Kiichiro to enter it, now was in the throes of a world-wide recession. In England, the state of the industry was so serious that, as negotiations proceeded with Platt Brothers in the summer of 1929, Kiichiro had come to have doubts about the future of manufacturing automatic looms. When negotiations drew near to a settlement, it was decided that Kiichiro would depart for the United States and England on 12 September 1929 in order to negotiate transfers of patent rights for Type G automatic looms. But the negotiations with the leading US loom manufacturers, Draper Corporation and Crompton & Knowles Corporation, ended in failure.

3. The Toyoda-Platt Agreement

i) Concluding an Agreement, and Its Contents

The Toyoda-Platt Agreement was signed on the 21st of December 1929. The contents of the Agreement has already been the subject of many publications and it is widely known. Here is how it is described in *Limitless Creation*, Toyota Motor Corporation's history of its first fifty years:.

Toyoda Automatic Loom Works gave Platt Brothers the exclusive right to manufacture and sell the Toyoda automatic loom in all countries except Japan, China, and the United States, in consideration for which it would receive a patent right transfer fee of 100,000 pounds sterling. Later, Platt Brothers claimed damages regarding loom manufacture know-how, and the fee was reduced by 16,500 pounds. The final version of the contract was exchanged in September 1934.^{3 3}

This description is almost a hundred percent accurate (only the explanation of the sale of Type G automatic looms to Toyo Podar Mills, Ltd. in India is omitted). Also, Yoshinobu Sato's *The Sources of the Toyota Business* contains a careful description of the clash with Japan's taxation office in regard to the timing of the tax imposed on the fee received from Platt Brothers, and the fact that a solution took some time.^{3 4}

Who were the two parties to the Agreement? One of the parties was Platt Brothers, naturally. But the other party was not Toyoda Automatic Loom Works. It was an individual--Kiichiro Toyoda. The reason the contract was made in Kiichiro's name was that he was the patentee for the "shuttle-change automatic loom" and other devices incorporated into the Type G automatic loom.

It is claimed in many writings that the Toyoda-Platt Agreement was motivated by Platt Brothers' desire to purchase the patent rights in order to quash competition. This view is expressed in *Limitless Creation*:

Though Platt Brothers bought the patent rights, it in fact did not make more than just a few of these automatic looms. This is what is known as "buying a patent to quash competition." Figuring that, if England and other countries started using the smoothly performing automatic loom, England's spinning and weaving industries would not be able to survive, Platt Brothers, because of its position, merely gained control of the patent right in order to protect English spinning and weaving companies.^{3 5}

Did Platt Brothers have the intention of quashing competition from Toyoda by purchasing the patent rights? And did Kiichiro, the other party to the contract, think that the agreement was a ploy on the part of Platt Brothers to quash competition? Let us look at the structure of the payments for transfer of the patent rights. At the time of the signing of the contract, Platt Brothers would pay Kiichiro £25,000. During the next three years, Platt Brothers would pay Kiichiro £25,000 every year, for a grand total of £100,000. If, however, the royalty of £4 for every loom did not reach the figure of £25,000 per year (that is, if Platt Brothers could not manufacture 6,250 looms a year), Platt Brothers would be obligated to pay Kiichiro a sum of £4,500 every half year for six successive half years, to be followed by payments of £4,000

every half year for twelve successive half years. In either case, the total would come to £100,000. This is what was stipulated about the £100,000 that, it is widely believed, was obtained from the Toyoda-Platt Agreement.^{3 6}

Just from these contract terms it is difficult to judge whether or not Platt Brothers had the intention of purchasing the patent rights in order to quash competition from Toyoda Automatic Loom Works, or whether or not Platt Brothers had some other motivation for letting the patent rights lie buried in a desk somewhere. In Platt Brothers' 19 March 1930 meeting of the board of directors, a decision was made to publish an advertisement in an Indian trade magazine for the purpose of stimulating sales of the automatic looms that would be produced under the Toyoda-Platt Agreement. It is, therefore, unlikely that Platt Brothers was intending right from the start not to use the patent rights. It is more likely that Platt Brothers really intended to produce and sell automatic looms on the basis of the Toyoda-Platt Agreement, but despite the company's efforts sales did not go very well. To find out if this is true or not, we have to look at how things proceeded after the Toyoda-Platt Agreement was concluded.

ii) Appraisal of the Automatic Loom

In accordance with the Toyoda-Platt Agreement, Toyoda Automatic Loom Works sent a technician, named Shusaku Suzuki, to Platt Brothers. Apparently Suzuki was an outstanding technician, because during his stay with Platt Brothers the company submitted an application for a patent (dated 21 February 1931) in which his name is given as joint inventor. On 13 May 1931, the Platt Brothers board of directors voted to present Suzuki with a gift to recognize his work during the fourteen months he had spent with the company, prior to his return to Japan. It was highly unusual for Platt Brothers to vote in a board meeting to present such gifts to individuals; they had done it only once before, on the occasion of the retirement of Sanji Muto, president of Kanegafuchi Spinning and Weaving Co. (a good customer of Platt Brothers).

Even before Shusaku Suzuki left Japan, interest in the Toyoda Type G automatic loom was high, thanks to a report in *The Textile Mercury* weekly newspaper.

The "Platt-Toyoda" is the name given to the new automated loom being made by Messrs. Platt Bros., of Oldham. It is a Japanese loom designed and intended to run at 240 picks per minute. Shuttle changing, when the pirns run empty, and also the weft breaks, is absolutely automatic.

The loom at present running at Messrs. Platt Bros.' Werneth Works, is working beautifully at 215 picks per minute. ... It is also expected that many existing

Lancashire looms will be converted to the Toyoda principle, and the intention is further that the “Platt-Toyoda” shall cover as wide a range of cloths as possible.^{3 7}

This article makes it easy to understand why interest in the Platt-Toyoda automatic loom was high. Most probably the people at Platt Brothers greeted Shusaku Suzuki with the expectation that they would be able to seize a marvelous business opportunity with this loom. Even Kiichiro would have been very pleased at the high praise heaped upon his loom in the specialist English weekly newspaper (so different from its reception in the United States). The Lancashire Cotton Corporation (LCC), the largest group of cotton mills in England, was considering the adoption of automatic looms. To determine whether to adopt the automatic loom, and if so which one, LCC decided to carry out performance tests from April 1931. Each manufacturer was to set up forty of its looms. At Platt Brothers, the production of the looms for this test was entrusted to Shusaku Suzuki. According to a report Suzuki sent back to Japan dated 14 March 1931, they had already assembled 37 looms and had three to go. Of the 37 assembled, 35 had already been delivered to LCC, and Suzuki had finished adjustments on 25 of them. It would seem that preparations were proceeding smoothly. His report contains, however, a note of anxiety about the upcoming tests.

The announcement that the examination of the performance of the Platt-Toyoda loom ... will take place from 7 April means that it will be too soon after the machines are put into action for the first time; because the wire healds are new, the large number of weft breaks will be higher than the number of weft breaks with the present Northrop looms. I am trying to negotiate a delay in the tests because it puts us at a comparative disadvantage.^{3 8}

In the lead-up to the performance tests to begin on April 7th, Suzuki had no time to think about anything except adjusting the looms. On the 1st of April he wrote to Japan: “Preparations finished; am convinced we can compete rather successfully if about 192 picks a minute achieved.”

Finally the day of the tests arrived. Those who have written about the event often cite the report from the Japanese Consul in Liverpool.

Lancashire Cotton Corporation, the largest cotton industry company in England with 8,000,000 spindles and 20,000 looms, began testing the performance of all types of automatic looms from the end of 1930 with a view to improving the machinery the Corporation is using. The loom for which Toyoda Automatic Loom Works has already transferred manufacturing and sales rights to Platt Bros. & Co., Ltd., located in Oldham, England--the so-called Platt-Toyoda loom--is also being included in

these tests. It seems that the results of these tests will not be made public for several months....³⁹

After presenting this background information on the performance tests, the Consul concludes as follows:

In short, if one looks at the test results as they stand at present, it is a contest among four looms: Northrop, Vickers-Stafford, Whittakers, and Platt-Toyoda. The three first-mentioned looms are a step ahead of the Toyoda loom in performance, because of the perfection of the machines and the skill of the operators. But it is said that, if the Toyoda loom makes a slight improvement in its present performance, it will far outstrip the other three looms.⁴⁰

Rather than conveying accurate information, the content of this report has more of the character of a chameleon. When the Consul penned this report at the beginning of May, he passed on the news that the Platt-Toyoda loom was less efficient than the Northrop and other two looms, but then he immediately added the statement that with a "slight improvement...it will far outstrip the other three looms". But he indicates that this is all hearsay, prefacing his own words with "it is said that." Interested parties who would receive a report like this would no doubt, because of their expectations, be inclined to hone in on the "it will far outstrip the other three looms" part. And in fact many people thought that the Platt-Toyoda automatic loom's results on the performance tests were good.

As the Consul's report said at the start, however, the actual results of the test would not be made public till several months later. The results of the automatic loom performance tests were published in the March 1932 issue of the *Journal of the Textile Institute*.⁴¹ The test results of the Platt-Toyoda loom were almost pathetic. As stated in the final report:

These were built by Messrs. Platt Bros. & Co. Ltd., of Oldham, and were the first 40 Toyoda looms in England. In consequence of this there have been many troubles due directly to the loom being a new production, and whilst a report can only be made on the results obtained, it must be borne in mind that Messrs. Platt Bros. are taking every advantage of their experiences at Higher Walton and many of the faults discovered will not occur again.

This type of loom has a very heavy slay and in conjunction with the comparatively high speed of 187 picks per minute a great deal of vibration is created with a detrimental effect on the yarn. The framing and crankshaft are not strong enough to hold the heavy moving parts. So great was the vibration that the looms ... pulled loose the bolts and had to be refixed.

One of the main features of the loom is an excellent warp let-off motion. There are rather too many set screws and bolts ... and the loom gives the impression of having had an attachment built into it instead of being a fully automatic weaving machine. The loom turns the scale at 18 cwts., the framing being light but the slay heavy.

There are also features which do not conform to American automatic loom practice; for example, the use of a heavy wooden cloth roller.... Chromium plating is extensively employed and has been a success for many small parts, and a failure for others. Time will prove its usefulness.

The loom is not well designed for the weaver as it is too deep for a short girl to reach across and too low. The warp stop is of a type which makes a broken end comparatively difficult to find, as time tests have shown. Again, the loom is very heavy to handle and the usual fast and loose pulley arrangement is not satisfactory for automatic weaving, as it puts too much physical strain on a weaver.

There has been an excessive breakage of loom parts, caused partially by the newness of the loom, but also accounted for by the extremely fierce action of putting a 15-in. shuttle into a fast running slay and ejecting the spent shuttle in one motion. The loom uses the side lever-picking arrangement which is very sharp in action and this is reflected in broken picking sticks and worn pick points.^{4 2}

In the discussion of the Northrop loom, its performance is praised highly, in stark contrast with the appraisal given the Platt-Toyoda loom.

How did the operating experiments carried out between 7 April and 31 July go? The quality of the cloth produced by each of the looms was, according to the report, roughly the same. The report recognizes that problems arose because of the newness of the Platt-Toyoda looms, but it also observes that “there are certain defects which need alteration” (p. 42).

Given this report, obviously no hope remained that Platt Brothers would be producing the Toyoda Type G automatic looms and selling them to LCC. What is more, even though the report assessed the Northrop loom highly as an automatic loom, it considered the Lancashire non-automatic power loom (i.e., the “ordinary loom”) to be more advantageous, cost-wise, when Lancashire labor practices were taken into consideration. As a result, LCC decided against introducing any automatic looms. Hence there was no possibility whatsoever that Platt Brothers would receive the large order from the Corporation for which it had been hoping. Even acquiring a sub-licence with another automatic loom was now out of the question. And now that the LCC appraisal of the Platt-Toyoda loom had been made public in a specialist magazine, it requires no stretch of the imagination to realize that prospects of selling the loom had become quite bleak indeed.

iii) Searching for an Explanation

Lancashire Cotton Corporation's assessment of the Platt-Toyoda automatic loom--that "there are certain defects which need alteration"--has been accepted at face value by present-day researchers outside Japan. In many textbooks and articles, assessments of the Platt-Toyoda loom make reference to the words contained in LCC's final report. It is not only historians who accept that this view of the deficiencies of the Platt-Toyoda loom. Even interested contemporaries on the English side, including Sir Walter Preston, who took over as president of Platt Brothers in 1930, were persuaded that the LCC report told the whole story.

But a nagging question arises at this point. If, as the final LCC report says, the Type G automatic loom's vibrations were so violent that the yarn snapped frequently and parts were being broken, why is it that Platt Brothers failed to discover these defects when they were testing the looms in their own factory? Why is it that the Type G automatic loom was being used in weaving factories in Japan as well, but there are no records of any such complaints being lodged against it, and in fact large numbers of the automatic looms were being bought? To give a comprehensive answer to these questions would be quite difficult, but it is possible to indicate a few plausible answers.

First of all, there could have been a problem with the yarn used for weaving. Furuichi recalled that the Type G automatic loom achieved 250 picks a minute for a few moments when the loom was demonstrated in the United States, but he added that "the yarn we had brought with us from Japan was the best of Toyoda Boshoku's yarns, and on top of that their preparatory processes and research on starch and so on had been thorough."^{4 3} In other words, the quality of the spinning yarn used in Lancashire Cotton Corporation's tests was inferior to the type of yarn the Toyoda Type G automatic loom was assuming.^{4 4} Either that, or it is possible that there was insufficient time to adjust the looms to the quality of the yarn. Yet, when the technicians from Platt Brothers were making a decision about the transfer of patent rights while observing with their own eyes the operations of the two Type G looms that had been sent from Japan, would they not have tested not only the yarn brought from Japan but also yarn used in the Lancashire district? Would they not have entered into negotiations for transfer of the patent rights precisely because, after witnessing such test results, they figured that the Type G loom could bear up under actual usage? If that is the case, then we cannot look for the cause of the problem in the inferiority of the yarn used in the Lancashire Cotton Corporation experiments. Of course, it is still possible that it was a combination of poor yarn and insufficient time to adjust the looms that was responsible for the inability of the Platt-Toyoda looms to run at top performance.

Still, even if the problem of yarn quality was a factor that cannot be discounted, why is it that the Type G automatic loom produced so much vibration and caused so much breakage of

parts? Is the principal cause to be found somewhere else? One possible conjecture is that there may have been a major problem with the method of producing the automatic loom frame and parts and the method of assembling them at Platt Brothers. The reason for such a conjecture can be found in the list of things that Shusaku Suzuki felt had to be improved in regard to production of the looms (the list was contained in the report that Suzuki was obliged to submit to Platt Brothers in accordance with the terms of the Toyoda-Platt Agreement).^{4 5}

The contents of Suzuki's report would startle anyone familiar with production techniques. Assembling on a level surface, or in other words, on a surface plate (Item no. 1 on the list), was not being carried out, even though it is the most basic principle in the assembly of precision machines. Shafts, which by their nature are supposed to be straight, were not straight (Item 2). Gauges were not being used properly (Items 6, 9, 10, 17). Not even the commonsense foundation of precision operations, measuring the center line, was in place (Items 4, 13). The materials being used in parts were inappropriate (Item 3.) The list goes on. Suzuki's report is very concrete, and it gives such a clear impression that the basics of production were not being followed that the reader of the report begins to doubt it can be true, even for that time in history. If Shusaku Suzuki had been just an average technician, the claim might be made that he had insufficient understanding of how production works. But he was an expert technician whose outstanding abilities were recognized by Platt Brothers' board of directors. Ought we not rather wonder if the production standards at Platt Brothers had fallen rather low? To answer this question we have to know what occurred at Platt Brothers after Kiichiro's visit there in 1922.

iv) A Decline in Platt Brothers Assembly Technology

In the autumn of 1922, several months after Kiichiro did work training at Platt Brothers, the company experienced an important turning point in its history. Until then almost all of its shares were owned by the founder's family, but the son who was to take over the Platt family's business affairs lost his life during World War I, and for this and other reasons the family decided to sell its shares that autumn. The company thus lost its character as a family business and became a public corporation in the true sense of the term. At that stage (1922) the company's future was considered bright. But then it met a succession of misfortunes. The slump in the Lancashire cotton industry had increasingly depressed the company's textile machinery sales. As spinning and weaving firms went bankrupt or were forced to integrate with other firms, the fine, first-class machines that were the backbone of the Lancashire cotton industry flowed into the secondhand machinery market, thus cutting into the market for Platt Brothers machines. From 1928 through 1931 the company did not declare any dividends, and in 1931 incurred a loss of £65,000.

The unemployment rate in the Lancashire district was high at this time. According to a 1932 survey, more than 30% of the workers in Oldham who were eligible for unemployment insurance schemes were unemployed. When you have a high unemployment rate and long-term stagnation in corporate performance, it is impossible to give workers sufficient pecuniary incentives. It is not to be wondered at, then, that Kiichiro noticed that morale was low in the plant in 1922, where it was the skilled workers who controlled all the operations on the factory floor. And when you have a company like Platt Brothers that is producing high-quality products, through very careful fitting of each and every part by skilled workmen, a drop in morale on the production site can be a big problem. The Platt Brothers management team at this time (1930), however, was paying attention to other problems. They were attempting to exercise effective control over production, prices, and profits through large-scale integration of textile machinery manufacturers at a time when the cotton industry was tending to shrink. Leading the merger action was Sir Walter Preston, who took over as president in 1930. After the merger, Platt Brothers' assets were written down by a massive 57%, and their capital was reduced from £3,700,000 to £1,600,000. If, during such corporate reconstruction, the nucleus of manufacturing remained under the control of the skilled workers, it is quite possible that the quality of the company's products suffered. Furuichi describes an episode that occurred during Preston's visit to Japan that leads one to think that this was in fact the case. . . . On the day before Preston and his associates were to sail from Yokohama, Kiichiro and Furuichi were invited to a farewell party aboard their ship. The first-class wine flowed freely during the meal, and when participants were beginning the dessert course, Preston made a remark to which Furuichi gave a good-intentioned reply.

Preston said, "Now that Platt has actually integrated several companies and quality has improved, I'm hoping you'll sell lots of our goods." I replied, "I really would like to satisfy your wishes, but... lately the quality of Platt goods has gone down. There are many mistakes. Isn't this because the good directors in charge of technology have gone elsewhere?" I was a bit drunk at the time, and when I thought about it later I realized I had committed a very big gaffe.^{4 6}

Furuichi says he meant well and only wanted to take the opportunity to pass on as much good advice to the maker as he could, because there were so many troubles with the Platt looms being produced then. But, not surprisingly, what he said was taken badly by Preston, and Furuichi had to mend the situation by apologizing. According to Furuichi, even the Mitsui Bussan senior executive who made him apologize consoled him later by saying, with a smile on his face, "Everything you said is true. Japan no longer has to look up to Platt."^{4 7} If this episode as recalled by Furuichi is accurate, it bears witness to the fact that it was not only the quality of Platt Brothers products that had declined, but the company's very

production capability as well.

The problem of Platt Brothers' production techniques was not just a matter of lower morale on the factory floor because of the absence of pecuniary incentives. Platt, which was heavily dependent upon its skilled operators for process management and progress management and the like on the production site, was, it is believed, negligent in its efforts to adopt new methods of manufacturing, such as the wide-scale introduction of specialized machinery. This negligence is evident in another episode described by Furuichi:

When they heard about a spinning machine finally being produced in Japan, Platt sent [John] Bissett, their director in charge of technology, to Japan. He asked to be shown around a parts maker's factory. When I took him around to a small shop ... the owner ... took out a number of different gauges from the drawer of a cabinet and brought them over, saying, "I make [the parts] so as to fit these." I remember that Mr. Bissett had this surprised look on his face. When he got back to his hotel he said if he asked a Platt worker how he would make a one-inch rod, he would probably get the answer: "Why, I guess all you have to do is turn it down to exactly one inch." "It's ridiculous," Bissett muttered.^{4 8}

Furuichi's account indicates that the skilled workers on Platt production sites did not possess the concept of allowances.^{4 9} To be more precise, all of them had their own ways of producing each individual part, and their own allowances, but when they were to make one part over and over again, they did not care too much about how to set a certain allowance up to such-and-such specifications or how to produce that allowance in a simple and easy way. That is why Furuichi could remark that "in those days, even in a place like Platt Brothers, they were letting allowances be determined by the worker's skill," and that Japanese spinning companies and manufacturers "were more advanced than Platt, at least as regards limit gauges."^{5 0}

v) Problems on Toyoda Automatic Loom Works' Side

The causes of the difficulties met in the production of the Platt-Toyoda loom were not all to be found on the Platt Brothers' side. The renowned historian of the cotton industry in England, Douglas A. Farnie, has pointed out that the blueprints that Toyoda Automatic Loom Works supplied to Platt Brothers in accordance with the terms of the Toyoda-Platt Agreement had over a hundred errors in them.^{5 1} What he says is probably accurate. Even though the Type G automatic loom had more or less reached the stage where it could be used, one could not say that the product was already perfect. Technicians were constantly making little

corrections and adjustments here and there. The Type G automatic loom went on being improved on the basis of the design drawing. To put it another way, it went on maturing as a product and went on increasing in degree of completion. The problem was that a system to notify the relevant department of this sort of daily modification of the blueprints so that the changes would be reflected on the actual production site did not seem to exist in the Loom Works. Jiro Iwaoka, former chairman of Aisin Seiki, had the following observations to make about the situation in those days.

Of course there was the original drawing of the [Type G] loom. But there was no time to trace over it, blueprint it, and send it to the [production] site. Design change after design change--there was no end to design changes. If you weren't careful, you forgot to note the change on the original drawing. This was the cause of us botching up the drawings at the time we sold the patent [to Platt]. We sent them a drawing that was a copy of a tracing of the original drawing. There was one place where we had made a design change partway through, from 1 1/16in to 1 3/16in, but it hadn't been changed on the drawing, and that was what went through to them. Well, the loom that we sent them was the new version, but the drawing hadn't been corrected; there was a big stink over this and I was given hell. There were a lot of misses like this. All because we had been making one change after another, see, and there was nobody [who could read drawings] in the place where drawings were fixed up after design changes were made, you see, and I was in charge of the site.^{5 2}

From this account it is clear that internal organization at Toyoda Automatic Loom Works was still at a stage in which there was no systematic procedure for exercising control of design changes and technical drawings/blueprints. Probably the person who was expected to see to such internal mechanisms did not have the time to attend to systematizing document management and communication flow within the company's organization.

Once the Platt-Toyoda loom received such a low appraisal in the performance tests held by the Lancashire Cotton Corporation, the Toyoda-Platt Agreement became a worthless piece of paper to Platt Brothers. The result was that a settlement was arrived at by a revision of the agreement in 1934, with a substantial reduction in the fee originally agreed upon for the patent rights. When Toyoda Automatic Loom Works exported Type G automatic looms to India in 1937, Toyoda was forced into a third round of negotiations with Platt Brothers. Then the onset of hostilities between Japan and China created an environment in which the very production of spinning and weaving machines could not be carried out freely in Japan.

There is no denying that attempts by Toyoda Automatic Loom Works to sell Type G automatic looms to India and elsewhere were delayed because of the existence of the Agreement; in this sense it can be said that Platt Brothers had let the patent lie buried in a

desk somewhere. But anyone standing in Platt Brothers' shoes would insist that there was no way the company could sell the looms after the pathetic results in Lancashire Cotton Corporation's performance tests. And Kiichiro did not have any positive reasons for explaining all the details of this Toyoda-Platt Agreement. The press in Japan were unanimous in playing up the fact that the global giant, Platt Brothers, had come knocking on Toyoda's door to ask for patent rights to the Toyoda automatic loom. Needless to say, such press coverage represented enormous publicity for Toyoda's Type G automatic loom. In such an atmosphere, going into all the details of the Toyoda-Platt Agreement fiasco was almost an impossibility--the more so if one was one of the parties involved in it. Moreover, the more that was revealed of the whole situation, the surer would be the adverse impact on sales of the Type G automatic loom. It would also be letting competitors know about the inadequacies in Toyoda's internal organization.

4. Conclusion: The Influence of Toyoda Platt Agreement over the Birth of Japanese Automobile Industry

The trip Kiichiro began on 12 September 1929 when he left Yokohama ended when, after finishing his business in the United States and England, he returned to Japan in April 1930 via the Siberian Railway. The trip had taken approximately seven months.

Toyoda Automatic Loom Works was a comparatively new manufacturing company, but in the process of tackling mass production of a complicated machined-and-assembled product like the automatic loom it had made astonishing improvements in its manufacturing capability in an extremely short time (especially the capability to produce large quantities of a standardized product). The major reason for this improvement was the fact that it had been forced, since the second half of 1927, to produce Type G automatic looms at the rate of 300 a month.^{5 3} The company found itself in a situation in which it would be unable to cope with demand if it lacked the capability to mass-produce products that required precision machining. For this reason, from 1927 on Kiichiro had been focusing on clearing away a variety of stumbling blocks in the production area.

By the end of the 1920s the company was one of only a handful of enterprises in Japan that had the manufacturing capability to handle large-quantity production of manufactured goods with a high degree of machined precision. No doubt it was for this very reason that it was chosen to be one of the companies to be visited in late October to early November after an international industrial convention held in Tokyo.^{5 4} Kiichiro must have been aware that, despite being a fairly new company, in the process of producing a complicated fabricated product like an automatic loom the company had acquired enough manufacturing capability

(especially the ability to mass produce) to give it a high level of competence that was, if not ahead of other companies in Japan, at least on a par with them.

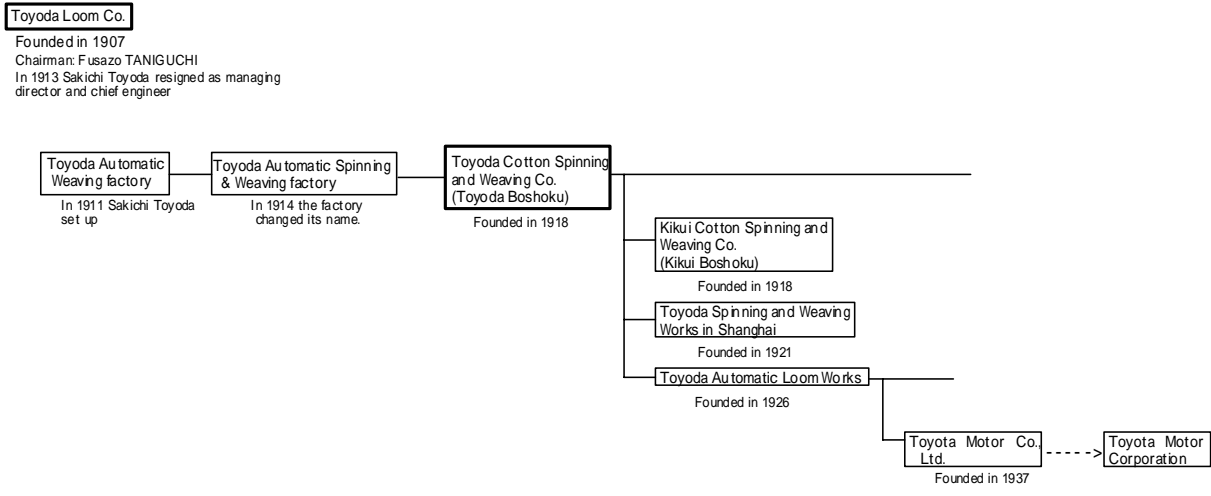
There is no denying that having a machine manufacturer like Platt Brothers acknowledge the commercial feasibility of the Type G automatic loom and then request a transfer of patent rights over the loom was a source of supreme pride and joy for an engineer like Kiichiro. Yet at the same time there remained that nagging question: why had Platt Brothers, of all companies, been unable to develop an automatic loom on their own? Could it be that they lacked the requisite technical capability? And why were proposals being brought up regarding the establishment of a joint company with Platt Brothers?

Rumors that Platt Brothers were in serious financial difficulties would have reached Kiichiro's ears even when he was in Japan. Now, Toyoda Automatic Loom Works was gradually looking more and more like Platt Brothers in what it was doing. Since the common apprehension at the time was that Japan was an industrial nation lagging far behind the countries of the West, it was only natural for people to imagine what Japan would be in the future by looking at the present state of the advanced countries. It required no special flash of genius, then, for Kiichiro to see in the present circumstances of Platt Brothers what Toyoda Automatic Loom Works might be like in the future. And what he saw in December 1929 and January 1930 was not something to make him optimistic about the future of Toyoda Automatic Loom Works; on the contrary, it made him very pessimistic. Until he had seen with his own eyes the situation in Oldham and at Platt Brothers, it was still possible for him to think the reports of the stagnation in the cotton industry were exaggerated. But then came the shock of seeing a town that was full of life in January 1922 transformed into a town teeming with the unemployed only eight years later, and to see a company that had been reaching for the stars eight years ago now struggling to survive. And it was this dramatic change in the short space of eight years that, I am convinced, made Kiichiro finally decide to go ahead with the concept that he had secretly been turning over in his mind: to enter into a new venture -- the automobile business. Therefore, once back in Japan, Kiichiro swung into action. Veteran employees of the old Toyota Motor Co. have testified that a month after his return to the country--in May 1930, therefore—"an automobile research room was set up inside the machine shop at Toyoda Automatic Loom Works, and work began on studying the automobile."

Any consideration of the financial aspect of the establishment of Toyota Motor Co. has to take into account the roles played by Toyoda Automatic Loom Works, Toyoda Boshoku, and Toyoda Spinning and Weaving Works in Shanghai. The first of these companies had invested up to approximately 17,000,000 yen in the automobile manufacturing business, beginning with the "automotive department" within its walls. The funds that enabled Toyoda Automatic Loom Works to invest such a huge sum came from profits it had made in the manufacture and sale of Type G automatic looms and ring spinning frames. Another

reason, however, was that, when the company increased its capital three times in the space of 22 months (in January 1934, July 1935, and October 1936), most of its shares were purchased by Toyoda Boshoku and the Toyoda company in Shanghai. As a result, as of March 1937 the top two owners of Toyoda Automatic Loom Works were Toyoda Boshoku (52.4%) and Toyoda Spinning and Weaving Works in Shanghai (33.3%), giving them a combined ownership of more than 85% of the shares. Thus it is clear that Toyota Motor Co. was first able to see the light of day because cotton-industry-related companies built up by Sakichi, Risaburo, and Kiichiro joined forces and gave the company strong financial backing. Even though the people heading the various Toyoda companies felt uneasy and hesitant when preparations were first being made for entry into the automobile business, once they became optimistic concerning the feasibility and viability of the business, they poured the required money into the new business without any hesitation. Thus it happened that the various firms in the Toyota group of companies would take on the role of providing venture capital and giving financial backing to Kiichiro's bold creation of a new business.

Fig.1. The relationship of the companies appearing in this paper.



*This paper is in tribute to the memory of Qiwen Lu.

Notes

¹ Tetsuro Nakaoka, “Jidosha ga hashitta” [The car ran], *Asahi Nihon no rekishi (bessatsu)* [The Asahi history of Japan], Supplement no. 16 (1978), p. 46.

² Mitsuhaya Kajinishi, *Toyoda Sakichi*, rebound edition (Yoshikawa Kobunkan, 1998). The first edition was published in 1962.

³ The suit against Toyoda was finally dropped and brought to a conclusion sometime in or around 1949. This is discussed in Tadaharu Tanaka, “Thoughts Seven Years after His Death,” in *Toyoda Risaburo shi denki* [The Biography of Mr. Risaburo Toyoda], ed. Tojiro Okamoto and Taizo Ishida (1958), pp. 129-30.

⁴ Mitsuhaya Kajinishi, *Toyoda Sakichi*, pp. 183-85. In their award-winning article, William Mass and Andrew Robertson (“From Textiles to Automobiles: Mechanical and Organizational Innovation in the Toyoda Enterprises, 1895-1933,” *Business and Economic History*, vol. 25, no.2) also generally accepts this legend as fact: They assert: “It is well known that, with Sakichi’s blessing, the fees from Platt Bros. were to be devoted to developing automobile-related research and development” (*Ibid.*, p. 33).

⁵ “Hundredth Day after Death: 250,000-Yen Giveaway---Entering into Last Wish of Mr. Sakichi; Over 6,000 Recipients in Nine Toyoda Factories,” *Nagoya Mainichi Newspaper*, 17 February 1931.

⁶ Kiichiro Toyoda, “Situation of Engineers in the Future,” *Corpus of Kiichiro Toyoda’s Documents*, p. 509.

⁷ Approximately half of the graduates found employment in private sector companies, and half of these were employed by companies in the shipbuilding and marine transport industries like Mitsubishi Shipbuilding (which took 7 graduates) and Kawasaki Dockyard.

⁸ Letter from Aiko to Kiichiro, dated 28 May 1921

⁹ Kikui Boshoku K.K., *Daijukkai hokoku* [Tenth annual report], October 1922; on p. 2 of this business report we find the words: “The extra spinning machines that had not arrived in the previous half [from

October 1921 to March 1922] were all operating in July.”

^{1 0} Among the items donated to the library of the Commemorative Museum of Industry and Technology by Eiji Toyoda, the eldest son of Heikichi and presently top adviser at Toyota Motor Corp., are three manuals explaining how to handle Whitin machines. Two of the manuals are dated 1919, the third is dated 1920. These would serve to confirm Kiichiro’s statement that he had learned how to handle a spinning machine and how to run a spinning mill from Whitin technicians, when Whitin spinning machines were being installed and put into operation.

^{1 1} “A Record of the Way in Which Toyoda Automatic Loom Works Grew Up: Reminiscences on the Automatic Looms,” in *Corpus of Kiichiro Toyoda’s Documents*, ed. Kazuo Wada, p. 39.

^{1 2} “Reasons Why Toyoda Automatic Loom Works Adopted the Shuttle-Change Method,” in *Corpus of Kiichiro Toyoda’s Documents*, pp. 52-54.

^{1 3} *Howa Kogyo hachijunen shi* [Eighty years of Howa Kogyo] (1987), pp. 10-11.

^{1 4} Toyoda Loom Works, ed., *Sogyo sanjunen kinen shi* [In commemoration of thirty years since the company’s foundation] (1936), p. 30.

^{1 5} Tadashi Ishii explains why: “A basic solution, at least as regards the structure of a shuttle change, was made by Sakichi’s invention (the automatic shuttle changer) Patent No. 17028, but from the viewpoint of a more practical automatic loom a few problems still remained. These were the problems of the temporal margin of error, at the time of the shuttle change, between the insertion of the replacement shuttle and the ejection of the old shuttle. In those days looms were already running at 200 picks per minute. Therefore, the shuttle would be parked inside the box for only an extremely short period of time, during which time the shuttle change had to be executed. If the change were delayed even a fraction of a second, it would immediately lead to snapping of some warp yarn. With Patent No. 17028, even though there had been not the slightest problem in the experimental stage, when it was produced in large quantities the tiniest margin of error in motion timing turned into a huge problem. The root of the problem was that the insertion of the replacement shuttle and the upward ejection of the old shuttle took place separately.” T. Ishii, “Tokkyo kara mita sangyo gijutsu shi--Toyoda Sakichi to shokki gijutsu no hatten” [The history of industrial technology seen from patents: Sakichi Toyoda and the development of loom technology], *Hatsumei* [Inventions] 76 No. 5 (1979), p. 23.

-
- ^{1 6} “Personal Account of Inventions,” *Forty-Year History*, p. 80.
- ^{1 7} “A Record of the Way in Which Toyoda Automatic Loom Works Grew Up,” p. 42.
- ^{1 8} Ishii, “The History of Industrial Technology Seen from Patents,” p. 23.
- ^{1 9} *Forty-Year History*, p. 84.
- ^{2 0} Mitsuha Kajiishi, *Toyoda Sakichi* [Sakichi Toyoda] (Yoshikawa Kobunkan, 1962), pp. 168-69.
- ^{2 1} Hatako Toyoda, “Reminiscences of the Shanghai Days,” in *Reminiscences of Akiji Nishikawa* (1964), p. 223.
- ^{2 2} Suketaro Tsukamoto, *Jinsei mawaributai--tairiku ni kakeru niji* [Life’s a revolving stage: A rainbow to the Continent] (Ohmi Kyodaisha Koseisha, 1988), p. 22.
- ^{2 3} “Reasons Why Toyoda Automatic Loom Works Adopted the Shuttle Change Method,” in *Corpus of Kiichiro Toyoda’s Documents*, p. 62.
- ^{2 4} Toyoda Cotton Spinning and Weaving Co., *Sixteenth Report* (1 April 1925 to 30 September 1925), p.2.
- ^{2 5} Toyoda Cotton Spinning and Weaving Co., *Seventeenth Report* (1 October 1925 to 31 March 1926), pp.2-3.
- ^{2 6} Tojiro Okamoto, chief editor, *The History of Toyoda Boshoku K.K.* (Nisshin Tsusho Kabushiki Kaisha, 1953), p. 49.
- ^{2 7} Kanegafuchi Cotton Spinning Co., *Kanebo hyakunen shi* [One hundred years of Kanebo] (1988), p. 164.
- ^{2 8} Toyoda Automatic Loom Works, *Yonju-nen shi* [Forty-year history], p. 115.
- ^{2 9} *Ibid.*, p. 114.
- ^{3 0} “An Account of the Workshop on Spinning and Weaving Technology at Toyoda Boshoku’s Kariya Factories,” *Boshoku-kai*, vol. 18 no. 3 (March 1927), pp. 10-11.
- ^{3 1} “Merger Talks between Toyoda Automatic Loom Works and Toyoda Loom Co.,” *Nagoya Newspaper*, 31 October 1929. Details of these negotiations regarding a tie-up involving the three companies can be found in Yutaka Taniguchi’s “A Cross Section of Japanese-English Relations in the Spinning and Weaving Machine Industry around 1930: The Problem of a Merger of Platt with the Two Toyoda Companies,” in *Economic Relations between Japan and Other Countries during the Period between the Wars*, ed. Kiichiro Oishi (Nihon Keizai Hyoronsha, 1992).

^{3 2} Toyoda Automatic Loom Works, *Jido no tomo* [Friends of TALW], Dec. 1929, p. 46.

^{3 3} *Limitless Creation*, (1987), p. 32. There was one exception for India: Toyoda Automatic Loom Works was allowed to sell to Toyo Podar Mills, which was operated by Toyo Menka Co.

^{3 4} Yoshinobu Sato, *Toyota keiei no genryu* [The sources of the Toyota business] (Nihon Keizai Shinbunsha, 1994), p. 49.

^{3 5} *Limitless Creation*, p. 32.

^{3 6} This is based on Lancashire County Council Archives, DDPSL 1/106/45. There were detailed conditions stipulated as well, but these need not be gone into here.

^{3 7} *The Textile Mercury*, 10 January 1930.

^{3 8} *Friends of TALW*, 10 May 1931.

^{3 9} *Dai-Nippon Boseki Rengokai Geppo* [Japan Cotton Spinners' Association Monthly Report], no. 466.

^{4 0} *Ibid.*

^{4 1} For some reason it is impossible to find a Japanese source that published the final results.

^{4 2} *Journal of the Textile Institute* (March 1932), p. 26.

^{4 3} Furuichi, "Looking to the Old and Finding the New," part 1, *Boshoku-kai* (October 1959), p. 23.

^{4 4} Indeed, in his analysis of the failure of the Lancashire cotton industry to adopt automatic looms, Lazonick has stressed the cost *advantages* that the Lancashire industry reaped from a system of production that may use of inferior (lower grade, lower staple, and hence more break-prone) yarn. See William Lazonick, "Industrial Organization and Technological Change," *Business History Review*, vol. 57, no. 2, (1983) pp. 195-236; and *idem.*, "The Cotton Industry," in Bernard Elbaum and William Lazonick, *The Decline of the British Economy*, (Oxford University Press, 1986), pp 18-50.

^{4 5} *Friends of TALW*, June 1931.

^{4 6} Furuichi, "Looking to the Old and Finding the New," part 3, *Boshoku-kai* (December 1959), p. 47.

^{4 7} *Ibid.*, p. 48.

^{4 8} Furuichi, "Looking to the Old and Finding the New," part 2, *Boshoku-kai* (November 1959), pp. 42-43.

^{4 9} On the British mechanical engineering in general in the interwar years, see Terry Gourvish, "Mechanical Engineering," in Neil K. Buxton and Derek H. Aldcroft, *British industry between the wars: instability and industrial development 1919-1939*, (Scolar Press, 1979), pp.129-155. As most mechanical

engineering firm ‘eschewed true interchangeability in favour of “selective assembly” which required more manual fitting but precision in machining,’ it was not just Platt Brothers that, lagged badly in terms of precision manufacture in the interwar period. See Jonathan Zeitlin, *Between Flexibility and Mass Production* (Oxford University Press, forthcoming) .

^{5 0} Ibid., p. 42.

^{5 1} D. A. Farnie et al., eds., *Region and Strategy in Britain and Japan: Business in Lancashire and Kansai, 1890-1990* (London: Routledge, 2000), pp. 142-43.

^{5 2} Interview with Jiro Iwaoka, 23 March 1976.

^{5 3} In the first half of 1927 the company had sold 1,397 looms, but it sold 2,021 in the second half of 1927, then 2,085 in the first half and 2,047 in the second half of 1928; and 1,862 in the first half and 2,142 in the second half of 1929. In the first half of 1930 this dropped to 1,226 looms, then to 766 looms in the second half, a drop of roughly half the previous years’ totals. Sales recovered in the first half of 1931, with 1,475 looms sold. See Toyoda Automatic Loom Works, *Forty-Year History*, p. 116.

^{5 4} See the “Foreign Participants’ Inspection Timetable” given on pp. 62-63 of *Kogyo no Dai-Nippon* [Industrial Japan], 15 July 1928.