

Chapter 2

Becoming Modern Corporation,
and Era of Automatic Exchanges
(1912-1936)

1. Establishment of Oki Electric Co., Ltd., and Growth under Third Telephone Expansion Plan

Merger of Oki Electric and Oki & Co., and improvement of management system

In August 1912, barely a month after the Meiji Period ended and the Taisho Period began, Oki Electric Company, Limited, was established separately from Oki & Co. The inaugural general shareholders meeting was held in the Nihonbashi section of Tokyo on August 26. Eiichi Shibusawa chaired the meeting, and Soichiro Asano, representing the promoters, reported on the process leading up to the company's establishment. Six directors and two auditors were then elected, and the directors subsequently elected Soichiro Asano as chairman and Umakichi Oki, Eitaro Kinoshita, and Kiyoshi Itoh as managing directors. After capital of 50,000 yen was paid in, Oki Electric Co., Ltd. (hereinafter "Oki Electric"), was officially registered on September 7, 1912.

The new company had 22 shareholders, mainly Oki Family members and well-known businessmen and financiers, including Take Oki, Kibaturo Oki Jr., Soichiro Asano, Eiichi Shibusawa, Zensaburo Yasuda, and Zennosuke Yasuda. Others included relatives of the Oki Family, long-term employees from the very first days of Oki & Co., and other influential persons requested by the Yasuda Family and Eiichi Shibusawa to participate. The Articles of Incorporation included an item stipulating that shareholders could not transfer shares to a third party without the company's approval. Based on this stipulation, the ownership of Oki Electric shares remained restricted from the company's establishment in 1912 until its first capital increase in 1936.

Oki Electric's business was officially listed in its Articles of Incorporation as the manufacture and sale of electric equipment, such as telephone and telegraph equipment, and electric lights. Oki & Co., meanwhile, continued in business as before, for two main reasons:

(1) in order for a company to be able to participate in bids for government contracts it had to have been in business at least two years; and (2) an ordinance issued by the Ministry of Communications (MOC) stipulated that Oki Electric's capital of 50,000 yen would not allow it to participate in bids larger than 25,000 yen.

Oki & Co. had long held the top position among the communications equipment manufacturers in Japan. NEC, however, a subsidiary of Western Electric (WE), had steadily bolstered its in-house production system, and in value of output and number of employees it was set to pass Oki & Co. From the technical aspect as well, it was taking time to localize the production of common-battery switchboards, and NEC, which utilized the materials and technology of WE, was opening its lead in the industry.

Soichiro Asano, senior adviser to Oki & Co., was closer to being a protector. Although it is not clear what he thought of the company's management at the time, Asano was known for his directness—rather, for his forceful methods—and he no doubt was irritated as he watched the company steadily lose its position as the industry leader. But members of the Oki Family and the company's senior employees firmly controlled Oki & Co.'s management at the time, and the system thus did not permit Asano's opinion to be reflected in management decisions. In that situation, however, Asano could not merely sit idly by and watch. Before long, he took action.

On August 30, 1916, Oki Electric and Oki & Co. signed a provisional contract to merge. Three items comprised the contract's principal content. First, Oki Electric would increase its capital at the time of the merger, and Oki & Co. would be dissolved. Second, Oki Electric would issue 20,000 paid-in shares and provide them to Oki & Co. for distribution to its employees proportionate to their equity participation. Third, Oki Electric would take over the employees of Oki & Co. and employ them in their current positions, and would succeed to all the rights and obligations related to accepting the employees.

Based on the provisional contract, it was decided at the general shareholders meeting of Oki Electric held on November 16, 1916, to merge with Oki & Co. The actual merger took place the following

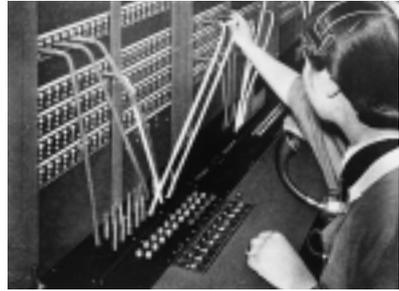
February. On the occasion of the merger, Oki & Co.'s capital of 1 million yen was deemed to be its total assets, and the full amount was transferred to Oki Electric as additional paid-in capital, increasing the company's capital to 1.05 million yen. It was thus not until 1917 that the entire operations of Oki & Co. were fully transferred to Oki Electric.

For a while after the merger, Umakichi Oki, Eitaro Kinoshita, Kiyoshi Itoh, and Totaro Katoh, men who had worked for the company since the days of Oki & Co., served as executives under Chairman Soichiro Asano. Gradually afterward, however, Chairman Asano took the initiative in reforming the company's management.

Chairman Asano took one of his first steps in April 1917 when he invited Suketada Itoh into the company from Toyo Steamship Co., Ltd., an Asano-related company, as managing director concurrently in charge of the General Affairs Department. At the same time, he had the authority of the board members, unspecified up to then, clarified in writing. Various rules and regulations were also established at this time, including the company's basic regulations. Chairman Asano then gradually began inviting into Oki Electric a group of men thoroughly knowledgeable in business management, and reorganized the company away from the former family approach.

Business expansion during First World War

This time happened to coincide with a period of brisk economic activity related to the First World War. The war, fought mainly between Germany and Austria, on the one hand, and France and England, on the other, lasted until 1918. Most of Europe was caught up in the fighting, and in the end even Japan joined the Allied Powers. Although Japan's economy was affected negatively at the war's outset, exports began increasing rapidly from the second half of 1915 and Japanese industry began benefiting from a strong war-related demand for products and materials. The nation's international balance of payments also turned favorable, and Japan reverted from being a debtor to being a creditor nation.



*Common-battery
switchboard*

The favorable wartime demand brought large profits to Oki Electric, for as the number of companies and plants increased in Japan, the demand for telephone service also increased. An especially strong demand emerged for Private Branch Exchanges (PBXs). In 1914, for example, when Mitsukoshi Department Store expanded its store in the Nihonbashi section of Tokyo, Oki Electric received a contract to install six common-battery switchboards, the largest PBX system in Japan at the time. Oki Electric received orders for PBXs from other private corporations as well, although its business until then was principally centered on orders from the MOC and other government and public agencies.

Overseas orders also increased. In 1915, through Okura-gumi Co., one of its sales agents, Oki Electric received a substantial order for 836 railroad-type printers. In 1916, a large order also came from Russia through Mitsui and Co., Ltd., for portable telephones and electric wire. Oki Electric produced 9,250 portable telephones in filling that order.

Following the end of the government's Second Telephone Expansion Plan in 1913, meanwhile, the budget of the MOC had been cut to only about 3 million yen per year. Due to the favorable turn in the government's fiscal situation due to the economic boom accompanying the war, however, the long-awaited Third Telephone Expansion Plan was put into effect. The first year of the five-year plan was the fiscal year ending in March 1917, right in the middle of the war years. With a budget of 22.5 million yen, the plan aimed for 75,000 new subscribers and installation of an additional roughly 32,600 kilometers of trunk lines. The plan underwent several revisions along

the way, and was also extended. It continued until the fiscal year ending in March 1935.

During the war boom, Oki Electric improved and expanded its operations while adopting a policy of aggressive business expansion. In May 1917, for example, the company focused on five product areas: (1) production of ordinary telephone and telegraph instruments, radiotelegraphs, and wireless telephony instruments; (2) processing and production of military-related goods; (3) production of signal instruments for railroads, and emergency alarms; (4) production of covered wire; and (5) manufacture of batteries. The company also moved forcefully to secure contracts for installation and construction work related to telephones and electric lights. Two other aspects of Oki Electric's business expansion were the setting up of a research laboratory to improve its production technology and, in response to MOC's telephone expansion plan, capital investments in new equipment and expansion of its plant. The research laboratory was made independent in December 1917, and the Construction Department was divided into the Production Department and the R&D Department. At the general shareholders meeting held on May 12, 1917, it was decided to increase the company's capital by 950,000 yen, raising it to 2 million yen.

As Oki Electric's management system steadily changed, the senior managers and other old-time employees from Oki & Co. days gradually retired. In June 1918, for example, Eitaro Kinoshita, Kiyoshi Itoh, and Umakichi Oki submitted their resignations and left the company. That completely ended all vestiges of Oki Electric as a family-run company, and the company started down a fresh, new path. It was decided around that time to have the board of directors meet once a week, on Mondays. Then, with Chairman Soichiro Asano and Managing Director Suketada Itoh in the center, top management began taking solid steps to provide Oki Electric with a modern system of management. According to company regulations dated 1920, the company's Head Office comprised four departments—General Affairs, Sales, Production, and Research and Development.

In 1919, Oki Electric purchased a plant in the Osaki section of Tokyo, refurbished it, and named it the Osaki Plant. It then trans-

ferred the wire manufacturing operations of the factory in Kyobashi and the R&D, capacitor, and battery operations of the Tamachi Plant to Osaki. The next new plant was built in 1920 in Dainin, an area just outside Osaka, as part of the company's move to bolster production for meeting demand in the Kansai region.

Around this same time, the company expanded its sales network nationwide. Liaison offices were opened in Sapporo, Nagoya, Kobe, and Fukuoka, for example, and the Osaka Liaison Office was upgraded to branch status. In 1920, to cover the funds needed for expanding and improving the production and sales organizations, Oki Electric increased its capital from 2 million yen to 2.5 million yen.

Oki Electric management also began to feel a need around this time for business ties with overseas manufacturers of communications equipment. Although a number of candidate companies were listed for consideration, WE was the only overseas company whose products met MOC standards. The company decided, therefore, that if it were to establish ties with an overseas company, the ties had to be with WE. Managing Director Itoh had already met the president of WE several times. WE, moreover, through NEC, had even sounded out Oki Electric's thoughts concerning possible ties. When the two companies began discussing ties, one of the first conditions WE mentioned was acquisition of at least 50 percent of Oki Electric's shares.

On January 21, 1920, Chairman Asano and Managing Director Itoh met with Eiichi Shibusawa and Zensaburo Yasuda to discuss the proposed ties with WE. All four men agreed that ties with WE were necessary for Oki Electric's future. They also agreed that for the time being the company would increase its capital by only 500,000 yen, with a larger increase of 2.5 million yen to be made if the talks with WE resulted in WE acquiring Oki Electric shares. The discussions with WE, however, were not successful. Although the reason is not entirely clear it might have been related to the serious recession that started in March 1920, and the subsequent drastic changes in the Japanese business environment. Despite the unsuccessful end to the discussions with WE, however, it is still abundantly clear that management at Oki Electric at the time considered forging ties with an overseas company as an urgent task.

Technical developments, and business management

NEC pushed forward with the domestic development of common-battery switchboards, utilizing materials and technologies from WE. Even so, its first delivery of a common-battery switchboard to a new telephone office was not until 1915. Delivery was to the Kanda branch office in Tokyo, the ninth branch office to be opened in the second MOC telephone expansion plan. The next delivery of an NEC common-battery switchboard was in 1916, to the Koishikawa branch office in Tokyo, the tenth branch office opened in the second MOC expansion plan. Oki & Co., meanwhile, was hindered in its development of a common-battery switchboard due to patent-related obstacles and the unavailability of imported materials. The first installation of a common-battery switchboard made by Oki Electric was in April 1918. It was installed at the Takanawa branch office in Tokyo, the eleventh branch office opened in the second expansion plan. That was nine years after WE produced its first common-battery switchboard, and three years later than the one NEC produced in-house.

Because it had delivered an expansion exchange to the Kyoto Telephone Office early on, Oki Electric later won orders for expansion exchanges after common-battery switchboards were installed in telephone offices in the six largest cities in Japan, including Tokyo, Osaka, Kyoto, Nagoya, and two others. Still, because it was necessary for Oki Electric to rely on imports for the main components of the switchboards, and because of the company's past experience of not being able to avoid patents, management—although it wished the company could produce common-battery switchboards in-house—was forced to realize the need to aggressively move toward introducing cutting-edge technology from abroad.

From around 1920, however, Oki Electric achieved notable advances in its technical development of a common-battery switchboard. At the board meeting held in February 1921, for instance, a special incentive bonus was approved for payment to two engineers. The award presentation explained that the bonuses were for the key contributions the two men had made from January 1920 in developing a

jack, an important component in switchboards. Subsequently, the MOC officially approved the jack and then purchased it on an experimental basis in May 1921. This purchase was significant for two reasons: first, the jack was the most important component in exchanges; and second, the purchase by the MOC proved that Oki Electric was able to produce a part in-house that up to then only WE could provide.

Oki Electric experienced another breakthrough in June 1922 with the successful development of carbon powder used in common-battery switchboards. Until then, the company had to rely on carbon powder imported from France, a product inferior in quality to WE's carbon powder. Oki Electric engineers had begun their research into carbon powder in 1918, and finally succeeded in July 1921 in developing a product whose quality was on a par with WE's carbon powder. This product made it possible to begin manufacturing telephones for common-battery systems at a quality level on a par with WE and NEC products. The project to develop the carbon powder involved a large number of engineers, with teams assigned to various technical tasks. In the development process, separate engineers were involved in testing of carbon powder, research concerning the electrical relationship between carbon powder and mechanical components, research of various raw materials, conducting product tests, and design and manufacture of electric furnaces for carbon powder. Indeed, it can be said without exaggeration that the availability of a large number of talented engineers made success in the development project possible.

An awareness of the need to be thorough in all work processes came to be felt strongly throughout Oki Electric. Chairman Asano impressed that need in a document he wrote dated July 1, 1921. That document reflects much of Asano's management philosophy.

"Although our company has realized favorable business results," he said, "the outlook is not good for rapid recovery from the current business slump. As well, competition with other manufacturers has intensified, making it necessary to be more determined and to exert greater efforts as we move toward the future. I would ask you to especially keep several points in mind."

Chairman Asano then listed the following five points.

1. Whether work operations proceed smoothly or not depends on the spirit with which you perform your duties; it is hoped that you will conduct yourselves in ways that profit the company's business.
2. Group work requires the maintaining of discipline; it is hoped that you will come to appreciate the importance of discipline and perform your work with enthusiasm.
3. Group work also requires cooperation and solidarity; it is hoped that while performing your official duties you will maintain close contact with each other, understand each other's intentions, and jointly plan ways to expand the company's business.
4. Be innovative in finding ways to improve production and produce quality products, and in considering the best way for rationalizing your work processes.
5. Pay careful attention to maintaining and expanding sales channels, so that the competition will not attract away your regular customers.

Strong efforts were exerted to make certain all employees were aware of Chairman Asano's ideas. The managing directors impressed the contents of the above document on staff members and junior employees, and the general managers did the same for the production workers. Viewed from management's eyes, Chairman Asano's comments touched on the many challenges Oki Electric faced at the time, including in-company discipline and cooperation, product quality and production rationalization, and expansion of sales channels. With its organizational operations placed in order under Chairman Asano, Oki Electric was now ready to improve the work morals of its employees, and to carry out thoroughgoing management control throughout the company. Doing so would prepare Oki Electric to win out in the increasingly severe competition it was facing with other companies in the same industry.

2. Dawn of Era of Automatic Exchanges

Great Kanto Earthquake, and introduction of automatic exchanges

Two minutes before noon on September 1, 1923, the Great Kanto Earthquake struck the Tokyo-Yokohama area. The earthquake and subsequent fires devastated the area. About 60-70 percent of all buildings were destroyed, and about 140,000 persons were either killed or missing. Of the 83,000 telephones in service in Tokyo before the earthquake, 64 percent were lost or damaged; of the 10,483 telephones in Yokohama, 90 percent were lost. Of the 19 stations in telephone offices in Tokyo, 15 were either destroyed or badly damaged; the central telephone and telegraph stations were also badly damaged. Telephone switching operations in Tokyo came to a virtual standstill.

Recovery work on the telephone system started immediately. The Aoyama, Koishikawa, Takanawa, and Ushigome offices in Tokyo were not seriously damaged by the earthquake or fire, and by the end of September they resumed temporary service. Restoration work was completed on six more telephone offices that resumed service during 1924. At the end of the fiscal year ending in March 1925, over 80 percent of all subscribers had their telephones back in service.

Although the earthquake completely razed the Mita Plant of NEC, the damage to Oki Electric's Head Office and Tamachi and Osaki plants was relatively light. In response to requests from the military, the MOC, and the Metropolitan Police Department, everyone in Oki Electric, from top management to production line workers, cooperated in restoring communications facilities in Tokyo and Yokohama back to working order. The company even loaned out the generator it had been using as the power source for its in-house switchboard, and provided parts and materials in response to requests from various organizations. At one point its warehouse inventories were completely depleted.

Based on the experience of the Great Kanto Earthquake, the government decided to begin automating all telephone exchanges. About two weeks after the earthquake struck, Section Chief Sannosuke Inada

of the Communication Central Engineering Section of the MOC commented clearly on the government's policy regarding restoration of telephone service between Tokyo and Yokohama. He said, "Restoration will be promoted using step-by-step automatic switching systems." This was the first public statement by a government official about the government's intent to install automatic exchanges.

Some persons in the MOC, in discussing restoration of the almost completely destroyed telephone network in Tokyo, said they wanted to restore services as soon as feasible and did not care whether the telephone exchange buildings were wooden structures or that the exchanges were common-battery types. But Sannosuke Inada and others in the MOC, who had been promoting research into automatic switching systems even before the earthquake, viewed the situation as a rare opportunity. Inada insisted that since the entire telephone network would have to be rebuilt anyway, the exchange buildings should be constructed more solidly and the exchanges should be changed to automatic types. MOC Minister Tsuyoshi Inukai is said to have made an immediate decision on hearing the options. "If the equipment is dependable and will profit the telephone network in the long term, we should take this opportunity to move ahead with automatic switching even if installation costs are more expensive."

Almon B. Strowger of the U.S. invented the automatic switch in 1887. The original device was structurally complicated, however, and installation was expensive, causing a delay in the commercial use of automatic exchanges. In the U.S., in particular, both Bell Labs and WE had made enormous capital investments in manual exchanges and were thus reluctant to change to automatic exchanges. It was only in 1922, for example, the year before the Great Kanto Earthquake, that New York City finally installed automatic exchanges. Although Germany and the rest of Europe led the trend toward automation of switchboards, statistics for 1919-1921 show that world-wide subscribers to automatic exchanges totaled only 490,000.

Of the several types of automatic exchanges available, Sannosuke Inada decided on the step-by-step system, considered the mainstream exchange at the time. It had already been in use in many countries and was highly reliable in terms of operation and ease of mainte-

nance. It also had outstanding earthquake-resistant characteristics. No one opposed Inada's decision. Two models of this exchange were available, the Strowger type made by Automatic Telephone Manufacturing Co. (ATM) of the U.K., and the Siemens type made by Siemens & Halske (SH) of Germany.

The first automatic exchange installation in Japan was for six telephone offices in Tokyo. The contract was for 8.14 million yen, the largest order the MOC ever made for imported equipment. Six companies were designated as supplier candidates: ATM and two other British companies, General Electric Co. (GE) and Automatic Electric, Inc. (AEI), of the U.S., and SH of Germany. The three British companies were affiliated with WE and had business ties with NEC. AEI and SH, respectively, had ties in Japan with companies such as Fuji Electric Co., Ltd., a joint venture established in August 1923, less than a month before the Great Kanto Earthquake, between the Furukawa zaibatsu and Siemens of Germany.

The MOC decided to award the first-stage construction contract to ATM. As ATM's sales agent in Japan, NEC received a bulk order. But because the bidding price for the automatic exchange was so high, the MOC decided it was necessary in the future to ask for competitive bids in order to reduce the price. That became the stimulus for the MOC adopting the basic rule of requiring multiple bids for contracts. For the second-stage construction contract the MOC decided to continue using the step-by-step system but to change to the Strowger and Siemens models.

Technical cooperation with GEC (U.K.)

Oki Electric began seriously considering the introduction of overseas technology related to automatic switches from 1924. The candidate companies it listed for possible ties initially included North Electric Manufacturing of the U.S., Ericsson General Telephone (Sweden), Peel-Conner Telephone Works Ltd. (PCTW)(U.K.) a subsidiary of General Electric Company Ltd. (GEC)(U.K.)(GEC[U.K.]), and Lorentz Co., Ltd. (Germany).

On May 1, 1925, the general manager of PCTW contacted Oki Electric and said his company wanted Oki Electric to be its agent in Japan. Oki Electric had been hoping for news like this, because PCTW was a designated supplier to the Ministry of Postal Affairs in the U.K. Fortunately, moreover, Kakichi Uchida, a former vice minister of the MOC and adviser to Oki Electric since September 1925, happened to be planning a trip abroad at that time. Oki Electric asked him to meet the principals of PCTW and negotiate ties with the company, and to tour the company's production facilities and study the exchanges they were manufacturing. An Oki Electric director and two engineers accompanied Uchida on the trip. In July, the three men arrived in Coventry, England, where PCTW's head office and plant were located. Oki Electric, meanwhile, in preparation for ties with an overseas manufacturer, finalized a plan for purchasing land and building a new plant. As part of those preparations, the company also doubled its capital to 5 million yen. The larger capital was felt to be necessary for raising the company's credibility in the event of successful business ties with an overseas manufacturer..

In late July 1925, Oki Electric received a memorandum of understanding (dated June 9) from GEC (U.K.) concerning the appointment of Oki Electric as the sole sales agent in Japan for products manufactured by PCTW. Based on advice from Kakichi Uchida, Oki Electric had its attorneys review the memorandum closely before submitting it for approval at the board of directors meeting held on October 30, 1925. Viewed from the speed of contemporary business, Oki Electric's response to the memorandum from GEC (U.K.) seems



Peel-Conner Telephone Works Ltd.

rather unhurried. But this was the first time for the company to attempt business ties with an overseas company, and management was probably just being prudent. Still, while continuing with its internal study of possible business ties with PCTW, Oki Electric also approached the MOC and requested that PCTW be added to its list of designated manufacturers, a request approved in September. Next, in December, due largely to efforts by Sannosuke Inada, promoted to chief of the Engineering Works Bureau of the MOC, the engineer Chuichi Yoshino of Oki Electric was sent for training at a technical school of the U.K. Ministry of Postal Services.

Oki Electric received a set of three draft contracts from GEC (U.K.) dated January 16: an agency contract, a distribution contract, and a manufacturing contract. Most of Oki Electric's conditions were reflected in the contracts, and inclusion of the manufacturing contract had not been expected but was welcomed because Oki Electric felt it was possible that the manufacture of automatic exchanges might be necessary in the future. The board of directors approved all three contracts at its meeting held on March 30, 1926.

Discussions with AEI in the U.S. were also held around this same time. Harry James, the Far East representative of AEI, visited Japan in January 1926. Senior Managing Director Kohei Oiwa met with James and asked him if AEI would consider business ties with Oki Electric. James asked detailed questions about Oki Electric's current business situation and its relationship with the MOC, and promised to contact his head office about Oki Electric's proposal. As it turned out, however, these discussions did not develop any further; AEI later set up its own branch in Japan and competed with NEC and Oki Electric in supplying the MOC.

In its second-stage construction project for installing automatic exchanges, the MOC decided to include four telephone offices in Tokyo and two in Yokohama. As a result of competitive bids, AEI won the contract for the four telephone offices in Tokyo for slightly over 7 million yen, and SH won the contract for the two telephone offices in Yokohama for 1.74 million yen. Oki Electric became an MOC designated manufacturer in September 1926, and was thus eligible to participate in bidding for the installation of automatic exchanges in Kyoto

and Nagoya, but it did not win either bid. Oki Electric (GEC [U.K.]) suffered another sales defeat when AEI also won a later bid to install an automatic exchange in the Asakusa telephone office in Tokyo.

Contracts with GEC (U.K.), and Shibaura Plant construction

Oki Electric chose GEC (U.K.) as a partner for business ties because it did not merely want to be a sales agent but wanted technical ties that would enable it eventually to manufacture automatic exchanges in Japan. That is why it sent the engineer Chuichi Yoshino to England for training at the technical school run by the U.K. Ministry of Postal Services, and why it moved as quickly as feasible to establish technical ties with GEC (U.K.). Finally, in September 1926, Oki Electric and GEC (U.K.) signed a technical agreement related to step-by-step type automatic exchanges. Based on this agreement, if the agency contract with Oki Electric related to the automatic exchanges that PCTW was manufacturing and selling was still in effect and it was decided to have Oki Electric manufacture the automatic exchanges in Japan, GEC (U.K.) would provide technical know-how to Oki Electric. Three principal items in the agreement were: (1) PCTW will accept engineers from Oki Electric and train them for one or two years; (2) PCTW will provide Oki Electric with the specifications, design blueprints, and know-how needed for manufacturing automatic exchanges, and will be reimbursed accordingly; and (3) for a period of five years, Oki Electric will pay PCTW royalties amounting to 3 percent of the value of its sales of automatic exchanges. This agreement made it possible for Oki Electric to eventually manufacture automatic exchanges.

Since its founding, Oki Electric had always developed telephones and exchanges independently. But the company knew from experience in developing common-battery telephones and exchanges that because the technology for automatic exchanges was more sophisticated it would take too much time to produce them in Japan without having technical ties with an influential overseas manufacturer. Oki Electric was a late-starter in working with automatic exchanges, and

based on its ties with GEC (U.K.) it was therefore necessary for it to move quickly toward in-house manufacture of the exchanges.

Oki Electric mobilized all its resources in the race with other companies to manufacture automatic exchanges in-house. In order to begin producing automatic exchanges within one or two years, however: (1) a pilot plant would have to be built separate from the company's other plants; and (2) skilled engineers would have to be invited from GEC (U.K.). While promoting technical ties with GEC (U.K.), therefore, Oki Electric formulated concrete plans for constructing a plant for the exclusive manufacture of automatic exchanges on reclaimed land it had already leased in the Shibaura section of Tokyo. The board of directors approved the plans in December 1926. In that same month, the company sent two engineers to the PCTW plant in England for training. Also, after making certain that living and other arrangements in Tokyo were satisfactory, the company invited two engineers from PCTW to come to Tokyo. In March 1927, moreover, Oki Electric employed Saburo Oshida of the Osaka Communications Bureau as chief engineer in charge of the project to manufacture automatic exchanges in-house.

Toward domestic production of automatic exchanges

Not very long after two of Oki Electric's engineers returned from training at PCTW's plant, two engineers from GEC (U.K.) arrived in Tokyo in August 1927 to provide technical guidance to Oki Electric's engineers. One was a tool designer named Gamble (phonetic); the other was a production engineer named Alderman (phonetic). As part of the preparations for the manufacture of automatic exchanges, Oki Electric set up a temporary department called the Provisional Automatic Exchange Start-Up Department. That department began functioning from December 1927. Its main missions were to reduce production costs and to reform the antiquated practices still seen in the Headquarters Plant. Specifically, unless absolutely necessary, the workers used up to then were not to be used in the manufacture of automatic exchanges, and female workers were to be utilized as much

as possible. Also, for staff members, appropriate persons were to be looked for first among present employees. If enough persons were not found, engineers with experience related to automatic exchanges in the MOC would be invited to join the company. Saburo Oshida was appointed general manager of the new department, and Tatsukuma Baba was appointed chief. The department had three sections: the General Affairs, Engineering, and Plant sections. The Oki Electric engineers trained at PCTW provided overall guidance.

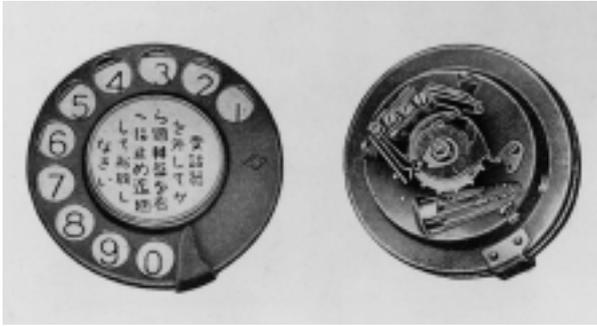
The first-stage construction of the Shibaura Plant was completed in August 1927. The two main buildings—Building A and Building B—had three stories above ground and one below, with a total of 3,100 square meters of floor space. The plant had 200 employees, and its cutting-edge facilities enabled a monthly output of 600 lines. Right around the time that construction was completed, the engineers sent to PCTW for training returned home. The timing was perfect for the arrival from PCTW of six automatic exchanges—one 100-line, two 50-line, and three 10-line exchanges—switch parts for 400 lines, jigs, gauges, small tools for assembly work, sample materials, and coiling machines. Oki Electric also ordered 26 new machine tools and 164 other types of tools. The company then commenced the in-house manufacture of automatic exchanges.

In order to meet the tremendous challenge of the in-house manufacture of automatic exchanges, a project that could well decide the very fate of the company, Oki Electric decided to introduce a new production system at the Shibaura Plant. At the time, a contracting system was in place in Oki Electric and all other companies in Japan's machine industries that dated back to the Meiji Period. The system in Oki Electric was called the "Union contract system." For every machine produced, the company contracted with a "boss" who managed each worksite. Skilled laborers worked under each boss, including those making castings, operating lathes, and applying plating finishes. These laborers had specialist technology they applied to each component, and they used their skills according to instructions from their boss. During this period, all products were manufactured in this way. The system made good use of the craftsmanship of the skilled laborers, and resulted in great solidarity between them and their bosses. A

former employee in charge of assembling exchanges at the time spoke of his experience with one of the bosses as follows. “I worked assembling exchanges for about 15 months and was then transferred to one of the parts inspection processes. One day I was surprised and happy when the boss gave me a new wristwatch. This was a guy normally very cold and tough on the workers. The watch probably cost quite a lot, and I was really moved.” That was the kind of atmosphere in the plants in those days.

This system helped to produce domestic-made products at a quality level on a par with imported products. It had serious drawbacks, however: the bosses were authoritative, for example, and their distribution of payments to the workers was sometimes unfair. Also, the bosses were proud of their craftsmanship and their masterful techniques, and thus tended to be conservative and to reject new technologies. The skilled workmen, meanwhile, used their own tools and gauges, resulting in margins of error different for each part, and time differences that slowed overall production. Besides those problems related to the system, problems also existed related to a willingness to work and to productivity.

The union contract system was developed over many years in Oki Electric’s plants. But automatic exchanges were much more complex, and required a much greater degree of precision in manufacture than the telephones, exchanges, and other equipment produced up to then. Unless jigs and gauges were standardized and systems of quality control and process control were put in place, there was no guarantee that the automatic exchanges could be manufactured satisfactorily. Three of the engineers trained in England—Oshida, Baba, and Umehara—had seen the production system at the PCTW plant of GEC (U.K.) and no doubt felt keenly the need to modernize Oki Electric’s system. The occasion of constructing the new Shibaura Plant offered Oki Electric the perfect chance to hire new employees and rid itself of the union contract system. An additional aim in inviting engineers from GEC (U.K.), the first foreign workers in Oki Electric, was to change the thinking of personnel at the worksite level, from the bosses on down. Oki Electric hoped to completely change the traditional labor-management relationship.



Front and back of Type-1 telephone dial

Under the guidance of the British engineers Gamble and Alderman, Oki Electric began manufacturing components for the automatic exchanges. As Saburo Oshida and the other engineers expected, the first task was to produce the necessary jigs and gauges. For producing the dial for the switch, meanwhile, an experimental model was prepared at the Tamachi Plant based on a sketch drawing of a dial made by Siemens Brothers & Co., Ltd. (SB). But when matched against dial blueprints obtained from PCTW, the dimensions were found to be slightly different. All the molds and tools thus had to be discarded and new ones prepared. Still, the technical expertise accumulated up to then served Oki Electric well. At the end of 1927, the first dial produced at Oki Electric passed MOC screening tests. The second dial passed the same tests in the spring of 1928.

After successfully producing the dial, Oki Electric next completed in rapid succession other important components for automatic exchanges, including the call meter, rotary switch, and switchbank. The component most difficult to produce was the two-motion switch mechanism, the key component for the step-by-step automatic exchange, which first moved vertically and then in a rotary motion in a horizontal plane. A sample mold for the two-motion switch mechanism was obtained from GEC (U.K.) but no matter how many times the foundry in Japan tried it was unable to produce a shaft of the required dimensions and quality. Although the foundry finally succeeded, it took far more time than originally expected.

As a result of untiring efforts, by the end of 1928 Oki Electric was producing most of the mechanisms and parts needed for manu-

facturing step-by-step automatic exchanges. Seemingly, all that remained was assembly. But then an unexpected problem arose. The MOC decided to standardize the automatic exchanges used at public exchange offices, using the AEI type. To avoid having one company monopolize the business, however, the MOC said it would accept automatic exchanges made by other companies as long as they were the step-by-step type. For Oki Electric, MOC's policy change was abrupt and required emergency action.

Oki Electric had invited engineers from England and moved steadily forward with producing automatic exchanges domestically. Although MOC's new policy thus dealt the company's plans a serious blow, it was impossible to overturn that policy once it was decided. The two basic mechanisms in Oki Electric's automatic exchange needing revision to meet the same specifications as the AEI exchanges were the rotary switch and the complex two-motion switch mechanism mentioned above. Basically, however, the differences were not so great, and Oki Electric's engineers now had experience with automatic exchanges. The changeover, therefore, did not take that much time. There was a flurry of activity at the end, but Oki Electric completed its first AEI type automatic exchange and delivered it to the MOC in April 1930 for supplying an additional 2,000 lines to the Nakano Telephone Office in Tokyo. PBXs, meanwhile, were not standardized around the AEI exchange, and GEC (U.K.) type exchanges were eventually installed in locations such as the Republic of Palau Post Office, the Osaka Railway Hospital, the Sakhalin Agency, and the Trade Representative's Office in the Soviet Embassy in Tokyo.

First radio broadcast in Japan

It took the Great Kanto Earthquake to impress on the government once again the importance of radio. Not long after the earthquake, the government decided to implement previously prepared plans for radio broadcasting. Establishment of the Tokyo Broadcasting Station was approved in 1924, the year following the earthquake, and broadcasting began from March 1925. For its part, Oki Electric

began working with wireless communications from early on. After the Wireless Telegraph Law was promulgated in June 1915 and the government began approving the establishment of private telegraph offices, Oki Electric applied for and received approval to establish a private radiotelegraph office for testing radio equipment. In that same year, the government's Electrotechnical Laboratory ordered two receivers with crystal detectors from Oki Electric, the first pieces of radio equipment the company ever produced. At this time, engineers from the Electrotechnical Laboratory were invited to join Oki Electric, and the company quickly established a full-scale system for R&D of radio equipment.

Following the development of wireless telegraph equipment, the invention of vacuum tubes made it possible to amplify electric signals, thus extending tremendously the distance that telegraph and telephone signals could be transmitted and leading to the development of radio broadcasting. From the fall of 1916, Oki Electric's engineers had already begun work on producing experimental vacuum tubes while referring to U.S. technical journals. Their products, however, did not provide sufficient amplification. The main problem was being unable to produce a really hard vacuum. A high-performance vacuum pump was needed to produce a hard vacuum but the only pumps Oki Electric had at the time were early model hydraulic pumps. As a last resort, the engineers burned magnesium powder to remove the remaining air from the tubes, but even then the results proved unsatisfactory.

In 1919, Oki Electric set up a radio equipment factory inside the newly built Osaki Plant and installed a high-performance vacuum pump. The new pump allowed Oki Electric's engineers to finally produce a triode valve. But basic patents related to an invention by Irving Langmuir of GE controlled triode valves used as receiving tubes for radios. Tokyo Electric Co., Ltd., claimed the right to those basic patents in Japan, and it thus became virtually impossible for Oki Electric to produce triode valves. In line with the start of radio broadcasting in 1924, the year following the Great Kanto Earthquake, Oki Electric put on sale at the end of 1924 three types of radio sets—a crystal type, single vacuum tube type, and three-bulb vacuum tube

type. Before long, however, the company was forced to halt its work on triode valves and its assembly and sale of radio sets.

Composition of top management, and abundance of talented employees

Oki Electric Co., Ltd., was established with Soichiro Asano as its chairman and, shortly afterward, Suketada Itoh as its managing director. As the company's business increased, the management staff was improved and expanded. Among the top managers, Director Takeshi Oze was appointed as the second managing director from December 1922. He graduated from the MOC's Civil Servants' Training Institute but afterward established his own trading company, Oze Shokai, in Seoul. Among the products he handled at that time were products of Oki & Co. Based on that relationship, in 1912 he was invited to join Oki & Co. He was appointed general manager of the Osaka Branch and made responsible for sales operations in the Kansai region. Next, he was appointed general sales manager at the Head Office in 1917, and a director in 1920. Oze was known widely for his sales competence.

At the board of directors meeting held on February 4, 1925, it was decided to hold regular board meetings once a month toward the end of the month rather than every week as was being done. This change indicates that the board of directors had moved away from making decisions regarding everyday business matters, largely leaving those decisions to the senior managing director, managing directors, and others. At the same board meeting, three points were decided regarding the authority vested in directors with representative authority.

1. The chairman of the board shall unify all company operations, call for board meetings, and act as chairman of the general shareholders meetings.
2. The senior managing director shall maintain order in the company's operations, and represent the company in ordinary legal matters; in case of an accident involving the chairman, the

senior managing director shall act on his behalf.

3. The managing directors shall assist the senior managing director in performing his duties and maintaining order in the company's operations; in case of an accident involving the senior managing director, the managing directors shall assume his duties and authority.

In this way, the authority of top management was put into order and the organization's overall decision-making mechanism was clarified in writing. The February 4, 1925, board meeting was also the venue for Managing Director Itoh's retirement and establishment of the senior managing director position. Kohei Oiwa was elected to that new position. Unfortunately, Oiwa died within about a year, and Monjiro Suzuki was appointed to replace him as managing director in December 1926. Suzuki came to Oki Electric from the Daiichi Bank, Ltd.; he was also a director of the Asano Family's holding company. He almost exclusively handled financial operations.

At the end of 1916, when Oki & Co. was dissolved, the company had about 400 employees, including 61 staff members. In November 1926, the number of employees in Oki Electric jumped to 1,670, including 177 staff members, and 108 apprentices at the lowest work level. So the number of employees roughly quadrupled in ten years, an indication of how the company had grown. A look at the overall corporate organization in 1926 shows the Head Office was comprised of two departments—the General Affairs and Operations departments. There were also the Osaka Branch and Liaison Offices in Sapporo, Nagoya, and Fukuoka. Although there were thus fewer departments than previously, the Head Office organization had been improved and expanded. The General Affairs Department, for example, was comprised of the General Affairs, Accounting, Commercial Affairs, and Sales sections, and a warehouse. The Operations Department was comprised of the Production, Design, Machine Tools, and Testing sections, a warehouse, and the Tamachi and Osaki plants.

As Oki Electric's organization expanded and the number of its employees increased, the number of middle-level managers also increased. To improve themselves these managers took the initiative in forming a club called the Reimeikai, and from December 1926 pub-

lished a monthly newsletter called the *Reimei*. One of the engineers who received technical training at PCTW in England contributed an article to the newsletter's first issue titled "The development of our association, and awareness of its members." In part, the article read:

"As middle-level managers, our mission is to serve as a buffer zone between the worker and capitalist classes. ... That is why we took the initiative in starting a movement toward implanting in everyone in the company a spirit of company-wide cooperation."

Formation of the Reimeikai showed that as the group of middle-level managers developed and improved, some of the members took it upon themselves to contribute proactively to the company's growth.

From around this same time, Oki Electric also put its retirement system and its system of awards for long-term service into order. These were enticements to encourage workers to remain with the company. The atmosphere within Oki Electric had also changed substantially since the company's founding in 1912, when much of the feeling of a family-run business still remained. The social situation at the time had raised the awareness workers had of themselves as laborers, an influence also felt inside Oki Electric. In June 1929, worker representatives from the company's three plants submitted a petition to management requesting improved plant facilities and stating their opposition to lowering the unit contract price. Then, in July, the workers in the Osaki, Tamachi, and Shibaura plants went on a simultaneous strike. The strike lasted over a month, and operations resumed only after negotiations were held between labor and management.

3. Showa Depression, and Economic Recovery

Soichiro Asano II installed as chairman

In June 1926, after Prime Minister Osachi Hamaguchi announced an austere fiscal policy and lifting of the embargo on gold, the deflationary trend in Japan's economy became more pronounced. Matters

worsened a few months later on Black Tuesday, October 29, 1929, when the New York stock market crashed a second time, marking the start of the Great Depression. The impact of the Great Depression also affected Japan's economy negatively: for example, prices for blue-chip shares on the Tokyo and Osaka stock exchanges dropped an average of 50.4 percent in the two years before and after the lifting of the gold embargo. In the two years starting from 1930, wholesale and retail prices dropped 30 percent. Sharp declines in the prices of agricultural products and raw silk, meanwhile, and poor harvests caused by unusually cold weather, directly and substantially affected the lives of people living in rural areas. A depression, called the Showa Depression (after the name of the era in which it occurred), hit Japan from 1930 to 1935.

After the Great Kanto Earthquake, the government expanded the budget in its Third Telephone Expansion Plan to restore telephone services in Tokyo and Yokohama. In the fiscal year ending in March 1925, however, it reduced the budget substantially to 13.87 million yen. Although it restored the level of investment again to 37 million yen, the budget was steadily decreased afterward following the seventh revision of December 1926. The recession resulting from financial instability and the Showa Depression had a further negative impact on the telephone expansion plan. In the eighth revision to the plan made in 1928, the budget was reduced further. And in the ninth revision of the expansion plan, made in 1930, after the government announced a fiscal entrenchment policy, the plan's annual budget was decreased to the 20 million yen level, less than half of what it had been before the ninth revision.

With the decreases in the budget for the telephone expansion plan, Oki Electric's sales continuously dropped between 1927 and 1931. Telephone sales were especially affected. In the fiscal year ending in March 1928, telephone-related sales totaled about 1.45 million yen, accounting for 44.8 percent of the company's overall sales. In the fiscal year ending in March 1929, however, those sales were less than 440,000 yen, less than a third of the year before, accounting for 22.5 percent of total sales. The poor sales performance for telephones continued in the following fiscal year, dropping to under



Soichiro Asano II

190,000 yen and accounting for 13.6 percent of total sales. In only two years, in other words, telephone-related sales dropped to one-eighth of what they had been. The lower budget for the telephone expansion plan also affected sales of almost all other products in Oki Electric's line, including exchanges, electric wire, and cables. Over the same two-year period, the company's net sales dropped to less than one-half of what they had been. Incidentally, an Export Section was set up in the General Affairs Department in November 1930 to handle overseas transactions as well as correspondence and coordination with overseas branches, offices, and agents.

The effects of the Great Depression spread to Japan, causing reduced hours of operation in industry and frequent labor strikes. In the midst of that chaotic situation, Chairman Soichiro Asano passed away on November 9, 1930. He was 82 years old. After Chairman Asano's death, his adopted son took his father's first name and was elected chairman of Oki Electric. Just two months later, in January 1931, Oki Electric celebrated the 50th anniversary of its founding.

During a discussion of representation rights at the board meeting held in January 1931, it was voted to have the company chairman represent general rights and Managing Director Oze represent sales rights and those related to the plants. The board also confirmed that Managing Director Suzuki would continue as before to represent bank-related rights. A system was thus adopted whereby the two veteran managing directors, Oze and Suzuki, would provide strong support to Chairman Soichiro Asano II, who had not previously been involved in Oki Electric's management. Also, shifting the sales and plant-related representation rights to Managing Director Oze assured

a system in which decisions concerning production and sales would be more smoothly reflected in business activities.

On September 8, 1931, the so-called Manchurian Incident broke out when a bomb ripped apart a section of the Japanese railway near Mukden (today's Shenyang) in northeastern China. Japan's economy started recovering rapidly from mid-1932, based on a robust military demand and a favorable turnabout in exports after the government once again prohibited gold exports. Even during the Showa Depression, meanwhile, telephone subscription applications had continued to increase, and as the economy recovered the number of applications started increasing rapidly. From the fiscal year ending in March 1935, the government moved its telegraph and telephone business to a special account, making it possible to expand related business plans. Meanwhile, when the state of Manchuria was established in March 1932, its economic development became a major task for the government. The Manchurian Telegraph and Telephone Company was established in 1933, leading to an expanded demand for telephone equipment and the start of construction on a communications line to connect mainland Japan with Manchuria. In short, a promising new market appeared for communications equipment manufacturers.

Competition in automatic exchange business

In April 1930, as an experimental purchase, a 2,000-line Strowger type automatic exchange made by Oki Electric was delivered to the MOC for use at the Nakano Telephone Office in Tokyo. The delivery schedule was tight and Oki Electric's engineers assembled the exchange by working around the clock. As a result of this successful installation, the MOC designated Oki Electric an official supplier of Strowger type automatic exchanges. Oki Electric then began receiving a smooth flow of orders from the MOC for automatic exchanges. These included installations at the Omuta Telephone Office in 1932, the Kaohsiung Telephone Office on Taiwan in 1933, and the Oji and Kayaba-cho telephone offices in Tokyo in 1934. Fuji Electric, meanwhile, through ties with Siemens, had entered the automatic exchange

business, resulting in intensified competition. A look at the value of total deliveries to the MOC in 1931 shows Oki Electric ranking second after NEC. In 1936, however, Oki Electric was passed by Fuji Electric and ranked third.

In 1930, the first year after automatic exchanges were being successfully manufactured domestically, WE developed a new type of automatic exchange using line finders (LF) that added an innovation in the switch mechanism. NEC began selling this new exchange in Japan. This new type was more economical than the existing line switch (LS) type of exchange, and was thus more appropriate for use at exchanges with fewer lines. It was certain to deliver a blow to LS-type exchanges in the PBX market. WE allowed free use of its patents for LF-type exchanges made for use in public offices but required patent fees for those made for PBXs. Oki Electric was thus forced to develop its own LF switch. Development took two years but the result was a smaller switch no less economical than WE's LF switch. Favorable sales of automatic exchanges with this LF switch allowed Oki Electric to rank on a par with NEC in the PBX market.

Based on its outstanding reputation in the PBX market, Oki Electric won a government contract in 1936 for all telephone facilities, electric clocks, and wiring in the newly constructed Diet Building. The LS automatic exchange with a capacity of 600 subscriber lines and 62 trunk lines earned such a favorable reputation that telephone technicians from provincial governments traveled to Tokyo on study tours just to view them.

In 1934, working jointly with Mitsubishi Corporation, Oki Electric participated in a bid for an automatic exchange to be installed in Bangkok, Thailand. Three other companies also submitted bids—Ericsson, NEC, and Siemens & Halske. Ericsson won the bid at a price about the same as Oki Electric's cost price. This experience taught Oki Electric the severity of competition in overseas markets.

As switches became more automated, new types of telephones were developed. The first such new type of telephone to garner attention was an automatic desktop telephone made by Siemens and sold in Japan by Fuji Electric for use with PBXs. To compete with this telephone, Oki Electric developed the i-661 desktop telephone for



Type-3 telephone

use with common-battery switchboards and automatic exchanges. It followed the i-661 with the Type-3 telephone in 1934. The MOC designated the Type-3 a standard telephone for its network, and about 600,000 units were sold until Oki Electric introduced the Type-4 telephone after the Second World War.

Creating R&D system

In January 1934, as part of the activities planned to commemorate the 50th anniversary of the company's founding, the first issue of the technical magazine *Oki Technical Review* was published. It contained a technical article on electro-acoustics, introductions of new products, such as an Oki interphone system and a loudspeaker, and other articles. In a short introduction to the new magazine, Chief Engineer Saburo Oshida emphasized the need for R&D in Japan's manufacturing industries. "As you know," he wrote, "a manufacturing industry is not built overnight. There are reasons why that is so. Seeds with great growth potential must first be planted, and an environment is needed for nurturing those seeds through a long period of gestation before they finally bear fruit and become a great tree." Oshida then mentioned three undertakings planned for commemorating the company's 50th anniversary: the first was completion of Building D of the Shibaura Plant; the second was publication of *Oki Technical Review*; and the third was creating an improved research system. Concerning the third undertaking, Oshida wrote: "Our company will invest large amounts of capital, and increase the number of exceptional researchers working exclusively toward resolving technical prob-

lems related to communications. Their work will allow them to contribute substantially to society and to the nation.” As his words show, Oshida believed that the road to survival for Oki Electric required a strong R&D system and improvement of the company’s technical capabilities. Toward this end, he and his fellow engineers took great pains in developing and accumulating technology.

In June 1933, the company prepared a set of rules titled, “Research and Trial Production Provisions.” Afterward, funds for research and trial production, formerly included in the budget for the Operations Department, were included in a separate framework. Funds for technical research were appropriated from each reporting period’s profits and placed in a reserve fund for use in research and trial production. An Examination Committee was also set up to decide whether to start particular research projects, and to evaluate their results. In a reorganization of the R&D system in 1934, the R&D and Technical Development departments were made independent of each other. The R&D Department’s functions included research, surveys, and patent-related matters; the Technical Development Department’s functions included design, estimates, and experimental standards.

Oki Electric invited Assistant Professor Katsuichiro Kobayashi of Tohoku University, an authority on electro-acoustics, to head the new R&D Department. Tohoku University was well known throughout Japan in those days for its research into weak electric currents. Prominent scholars such as Professor Hidetsugu Yagi, the inventor of the Yagi antenna, were among the faculty members. Under General Manager Kobayashi, the R&D Department moved forward especially in the areas of sonar and radio equipment. The department also developed a teletypewriter for commercial use and conducted research into carrier equipment.

Oki Electric was a latecomer in radio equipment research. In 1925, however, the government established Nippon Radio and Telecom (NRT), a public policy company, to supply radio communications equipment for use overseas. Kakichi Yoshida, an Oki Electric adviser, was appointed the company’s first president. Shortly afterward, NRT requested Oki Electric to produce an experimental short-

wave receiver, and seconded an engineer to Oki Electric. The company's engineers received invaluable experience from this project, and before long the production of radio equipment was in full swing. In 1931 and 1932, Oki Electric received orders from the Navy for special L&MF receivers for ships, from NRT for a triple-diversity, short-wave, large-size receiver, and from the MOC for a medium-size, short-wave, 6-tube superheterodyne receiver. The company also delivered large telegraph and telephone receivers to Manchuria and to the newly established International Telephone Co. (in 1938, merged with NRT to become International Telecommunications Co., Ltd.).

In 1935, based on these foregoing accomplishments, Oki Electric set up a Wireless Communication Systems Department that integrated the research, design, and manufacture of radio equipment. At the same time, it signed a patent licensing agreement and sales contract for vacuum tubes with Tokyo Electric. Oki Electric had confidence in the manufacture of large receivers but had frequently lost out in bids for transmitters to the MOC and the military because it could not produce its own vacuum tubes. The agreements with Tokyo Electric hastened Oki Electric's in-house production of transmitters, and in 1936 the company delivered the newest model 1kW relay-type 3-wavelength switchable short-wave transmitter to the Aviation Agency of the MOC. Also in 1936, Oki Electric received an order for broadcasting transmitters from Japan Broadcasting Corporation (today's NHK after merger of broadcasting stations in Tokyo, Osaka, and Nagoya), and produced two 500W transmitters for the broadcasting stations in Onomichi and Oita, and two 500W mobile transmitters.

After the R&D Department was set up, research activities at Oki Electric turned brisk. Research into the electro-acoustics field was especially notable. Around 1933, research was conducted into Rochelle salt as a new electro-acoustic converter, as well as into electromagnetic high-efficiency receivers and moving coil receivers. The Navy, meanwhile, had collected information on German sonar equipment and was especially interested in Oki Electric's electro-acoustic technology. In 1937, the Naval Technical Research Institute requested Oki Electric to produce a domestically made hydrophone mainly for

submarine detection. A Special Project for Research and Trial Production was then set up, with Katsuichiro Kobayashi as project leader and including 20 researchers and production workers. The German Navy was reported to already be using hydrophones, and the Oki Electric project team quickly turned to research and trial production. The system the team developed included a number of underwater omnidirectional microphones arranged to detect the direction from which sound was generated by using the time lag of the arrival of sound waves. This project marked Oki Electric's first experience in producing sonar equipment.

Additional plants built, and organization expanded

In response to the increased production of automatic exchanges and communications equipment, the second phase of construction of the Shibaura Plant, Building C, was completed in 1930. The full-scale production of automatic exchanges was underway, and the Provisional Automatic Exchange Start-Up Department was renamed the Shibaura Plant. Next, in September 1933, together with a recovery in demand, a plan took concrete form for building an extension to the Shibaura Plant on an adjoining site that had previously been purchased. The board of directors approved construction of Building D, a structure that would absorb the Osaki and Tamachi plant operations. That was the third-stage of the overall Shibaura Plant construction project. When completed in 1934, Building D had five stories above ground and one story underground. The overall plant came to cover an area totaling 25,000 square meters. With the opening of Building D, the Tamachi Plant was closed, the Head Office was moved in December 1934 to the Tokio Marine & Fire Insurance Annex Building in the Marunouchi section of Tokyo, and all wireless operations were moved from the Osaki Plant to the Shibaura Plant.

The total number of Oki Electric employees had decreased to 1,168 persons in 1931, during the Showa Depression, but began increasing again from 1932. In 1936, the number increased to 2,606 persons (including 751 temporary workers). The lowest number of



Shibaura Plant

regular workers was 532 persons, recorded in 1933. That figure more than doubled to 1,120 persons in 1936. This increase in the company's size led to expansion and improvement of the overall organization. In April 1934, the company introduced widespread reforms in the Head Office organization. Of the previous two departments, the General Affairs Department was left as is but the Operations Department was divided into the R&D, Technical Development, Engineering and Production, and Wireless Communications Systems departments, making a new total of five departments.

In the fiscal year ending in March 1925, sales of telephones and exchanges accounted for almost 70 percent of Oki Electric's total sales. Afterward, however, the company's product line became more diversified. Together with a decrease in the budget for the MOC's telephone expansion plan, sales of cable and radiotelegraph and telephone equipment, dry cells, and electric condensers came to account for close to 30 percent of total sales. Sales of telephones and exchanges, on the other hand, decreased to slightly over 50 percent of total sales. Among military demand, orders from the Navy accounted for only 6.4 percent of total sales in 1931. After the Manchurian Incident, the military demand—both from the Army and the Navy—increased. In 1933, total military demand accounted for slightly over 20 percent of sales.

In 1927, Oki Electric signed a sales agency agreement to have Okura Trading Company handle its transactions in China, Korea, and Taiwan. In 1932, however, an Oki Electric representative was stationed regularly in the Seoul Branch of Okura Trading. Also in

1932, when the three provinces in northeastern China and Eastern Inner Mongolia (Jehol Province) joined together to form Manchuria, Oki Electric stationed a representative in the Fengtien Branch of Okura Trading. After the Manchurian Telegraph and Telephone Company was established in 1933 to improve the communications facilities in Manchuria, orders to Oki Electric increased rapidly. Okura Trading became unable to handle the increased business, and Oki Electric then set up branch offices in Dalian and Harbin in April 1934. It also opened a branch office in Shinkyō (today's Changchun), the capital of Manchuria, in 1935. After war broke out with China, it added branch offices in Beijing in 1938, Jinan in 1939, and Tianjin in 1940.

Domestically, meanwhile, Oki Electric spun off one of its traditional businesses and made it an independent affiliate. In June 1936, the government approved establishment of Oki Electric Cable Co., Ltd. Although the electric wire business had been one of Oki Electric's most important divisions since its establishment, two main reasons for spinning it off had become more apparent: first, the manufacture of wire was intrinsically different from the manufacture of communications equipment; and second, other companies were already moving to spin off their wire manufacturing operations as independent companies. In August 1936, Oki Electric Cable Co., Ltd., was established with capital of 1 million yen (paid-in capital of 500,000 yen). It succeeded to all the facilities and employees at the Osaki Plant.

In June 1936, Oki Electric doubled its capital from 5 million to 10 million yen. The additional capital was needed for expanding the facilities at the Shibaura Plant to meet the increased demand for products, to respond to the expansion of overseas markets, and to strengthen and improve the company's R&D capabilities. Current shareholders were allotted one share of new stock for each share held. At the same time, the item in the company's Articles of Incorporation that had continued since 1924 to restrict the transfer of shares to third parties without company approval was eliminated. It was also agreed, however, that if major shareholders such as Yasuda, Asano, or Shibusawa wanted to transfer shares among themselves they would first obtain the approval of the board. Together with the expansion of the company's business, a need emerged to procure funds,

and allowing the transfer of shares became inevitable to attract more shareholders. Oki Electric, based on the agreement of its major shareholders, thus moved to secure stable shareholders.