Chapter I

Establishment of Osaka Kinzoku Kogyo Co. (1934–1972)

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An international system that promoted naval disarmament was in place during the years between signing the Washington Naval Treaty in 1922 and holding the London Conference in 1930. In the backdrop of an international consensus, a main aim of that system was to contain Japan's military expansion. Until the late 1920s, Japan faithfully downplayed its military while conducting its foreign affairs. Gradually, however, the Japanese Navy introduced a series of plans to foster advanced technology and improve the structure of its fleet. By carrying out those plans, the Japanese Navy strengthened its fighting capabilities, put its air wing into order, and introduced specialized warships. Those plans included

a system for cultivating designated civilian suppliers to support the Navy's in-house production activities.

In 1931, the Navy designated Osaka Kinzoku Kogyosho (OKK) an official supplier of compressed products. Besides products OKK marketed in the past, such as the "Rational Lubricator(s)", steam heating units, water cooling units, and carbon gas fire extinguishers, it also began selling to the Navy products such as aircraft components and brass piping for radiators. Next, in 1933, after the Army also designated OKK an official supplier, the company began selling a wide range of products, including cartridge cases, fuses, and radiator tubes for aircraft. The Army and Navy designated about thirty companies nationwide as official suppliers, including Hitachi, Ltd., Mitsubishi Aircraft Corporation, and Sumitomo Copper Works (later Sumitomo Metal Industries, Ltd.; today's Sumitomo Metal Corporation). Most of the Army or Navy designated suppliers were large, highly respected corporations. It was a distinct honor, therefore, for a small limited partnership such as OKK to be an official supplier.

Osaka Kinzoku Kogyo Co., Ltd. (OKK Co., Ltd.), meanwhile, was established on February 11, 1934. The driving force for establishing a stock corporation alongside OKK was a request to President Yamada from Sumitomo Copper and Steel Piping (SCSP) in September 1933 concerning possible capital ties. At the time, OKK was purchasing bronze sheets and bronze bars from SCSP to produce cartridge cases, fuses, radiator tubes, and other products. SCSP likely favored OKK as an Army and Navy designated supplier producing specialized products that required sophisticated technology. The new company, OKK Co., Ltd., meanwhile, had to think carefully about the possibility of having capital ties with a major company in the Sumitomo zaibatsu with a long history of smelting copper dating back to the early seventeenth century.

Also, SCSP's paid-in capital was 50 times the size of OKK's capital, and when the company merged with Sumitomo Steel Works a year later and became Sumitomo Metal Industries, Ltd. (SMI), the new company's capital jumped to 80 times OKK's capital, making it one of the largest corporations in Japan. Viewed from President Yamada's eyes, capital ties with SMI offered two especially attractive points: one was an increase in the company's social credibility; the other was the support that could be expected from SMI if business floundered. After careful consideration Yamada decided it was best to take advantage of this exceptional opportunity. He established OKK Co., Ltd., not long afterward, and set three conditions for SMI's participation in the new company: 1. SMI would not own more shares than President Yamada; 2. the number of Sumitomo directors sitting on the board would not exceed the number of OKK directors; and 3. SMI would not interfere with the technical or business policies of OKK Co., Ltd. All three conditions were important matters to Yamada for ensuring the managerial integrity of OKK Co., Ltd. Sumitomo accepted the three conditions, and its board approved the agreement for capital ties. Seven months later, in July 1934, OKK Co., Ltd. increased its capital from 250,000 yen to 1 million yen. Of that total, Sumitomo participated with equity of 495,000 yen. Seven months later, in February 1935, OKK Co., Ltd. merged with and absorbed OKK. The paid-in capital of OKK Co., Ltd. (OKK) at that time was 1.5 million yen; Sumitomo's equity remained at 495,000 yen.

OKK hired many new technical personnel. Besides experts in weapons production who moved from Osaka Artillery Arsenal (OAA) and Toyo Yasuri Shindo (TYS) to the company right after its establishment, two men with especially colorful backgrounds who also joined OKK were Kazuo Okamura from Onoda Cement Co. in 1931 and Gosuke Kato from Kisha Seizo Co. in 1933.

Posing with First Prototype Cooling Unit

OKK received a new request from the Ministry of the Navy in 1933 related to providing heating and cooling units for use aboard warships. The equipment the Navy was using at the time was bulky and performed poorly. OKK engineers immediately began to study the development of new units. The company already had much experience producing radiator tubes, and had developed products such as an instantaneous gas water heater. Its customers highly evaluated the company's technology and experience related to radiation, cooling, and heating equipment. Technicians in OKK decided that the main problem with heating and cooling units the Navy was currently using was related to the heat exchanger's structure. To alleviate the problem, OKK engineers inserted a spiral-shaped plate into the copper pipe, which increased the heat efficiency substantially and contributed to reducing the volume and weight of both the heating and cooling units. Doing so also tied to reduced operating costs, a clear response to the Navy's request for improved heating and cooling units. OKK applied for a patent to cover the spiral construction, and in 1933 completed prototype equipment for a heating unit and a year later for a cooling unit. The heating unit used steam as its source of heat, and the cooling unit used water cooled to between 4 and 10 degrees centigrade. OKK called the functions of the cooling and heating units "air conditioning," leading-edge wording at the time. The heating

units were installed mainly to heat the crew's berthing space; the cooling units were installed both there and in the ammunition storage area for cooling and refrigeration. Although the Ministry of the Navy required competitive bidding for items to be installed aboard its newest warships, OKK won many of the bids.

OKK utilized the same technology it used with the military to develop heating and cooling units for non-military use. In spinning plants, for example, it installed heating and cooling units from around 1929 to prevent the spinning thread from breaking and to improve the product quality. Customers used well water for the cooling units and exhaust air from their plants for the heating units. OKK sales engineers recognized those needs and promoted installation of the heating and cooling units. Also, based on requests from the Navy, OKK developed a lubricant oil heating system for use with aircraft. At the time, the use of spiral tube technology was helpful. Use of the lubricant oil heating system made it possible during the winter and in cold regions for military aircraft to take off before their own engines warmed up. The lubricating oil was heated in advance and pumped into the aircraft engine for starting. Sets of such equipment were loaded on flat carts for easy transfer.

After the London Conference of 1930, Japan and the United States both made strong efforts to improve their submarine fleets. In that same year, a research team of Frigidaire Co. developed a refrigerant called fluorocarbon. Frigidaire was a home appliance manufacturer wholly owned by General Motors. Frigidaire and DuPont then established a joint venture to begin commercial production of fluorocarbon. Around that same time, a U.S. submarine experienced an accident caused by leakage of ammonia gas or carbon dioxide from cooling units. Upon learning about the safety of fluorocarbon the Navy decided to switch immediately to using

Kazuo Okamura

fluorocarbon as its refrigerant of choice. Tomio Ohta, a retired Japanese rear admiral serving as an adviser to OKK, happened to read an article about fluorocarbon in a U.S. Navy publication. He immediately recognized the importance of fluorocarbon and passed on the information to President Yamada. Meanwhile, Kazuo Okamura, manager of OKK's sales department, told President Yamada that he wanted to tackle the fluorocarbon business as his lifetime work. He also recommended to OKK that if it intended to develop fluorocarbon it should also develop a refrigerator.

Even as militaristic colorings rapidly strengthened in Japan, Yamada began thinking ahead, of the days when peace would come, and about developing products for use by ordinary Japanese consumers. He decided that in aiming for future popular demand, freezers would be one of the most appropriate products. In that backdrop, OKK began its R&D of fluorocarbon in 1933, and around the same time also began developing a freezer. A close look at that situation reminds one of the days many years earlier when President Yamada, a mechanical engineer by trade, challenged on his own the development of a non-toxic paint for military field cookware. That showed how Yamada viewed matters from a long-term perspective. In effect, OKK's business foundation of air conditioning and fluorine chemicals had its start back then.

Toru Iwaki (left)
Masato Hirata (right)

Toru Iwaki, meanwhile, a researcher in Shionogi Pharmaceutical, found time outside his own job responsibilities to work closely beside Okamura in developing fluorocarbon. Using tools from a test lab, the two men purchased a small volume of 3-fluorinated antimony at a pharmaceutical wholesaler in Doshomachi, Osaka. In December 1935, after a series of trial-and-error experiments, they finally succeeded in synthesizing Japan's first fluorocarbon R12. In the process, holding two jobs proved to be too much for Iwaki, and shortly afterward he collapsed from exhaustion. OKK then hired a researcher named Masato Hirata in January 1937 and assigned him to work with Okamura. OKK established a Chemical Research Section not long afterward. Three months later the company provided the Ministry of the Navy with a written report on its research, together with product samples. That same November, OKK produced and successfully tested a 10kg batch of fluorocarbon 12, thus taking the company a step further toward volume production.

Concerning development of a refrigerator, meanwhile, the first steps included purchasing an American-made unit to use for reference. It was a 1hp unit that used methyl chloride as its refrigerant. In order to prepare an in-house product, the first step was to disassemble the sample product and sketch the various parts. Kazuo Okamura, who worked so assiduously on the fluorocarbon

project, was placed in charge of the refrigerating equipment development project. OKK produced its first refrigerator in 1934 and sold it under the trademark "Mifujirator." In 1936, a cooling unit was installed in a commuter train of the Nankai Electric Railway in Osaka on an experimental basis. The unit performed well, and from 1937 Japan's first air conditioned express made its debut run between Nanba in Osaka and Wakayama City. In that same summer, Nankai Electric Railway began operating air conditioned sightseeing buses.

In July 1937, however, war broke out with China, and from September the Japanese government introduced strict wartime controls. In that stringent situation, the Railways Ministry informed Nankai Electric Railway that air conditioning was an unnecessary luxury and must not be used aboard trains or buses. Japan's initial air conditioning operations aboard trains and buses thus ended after one summer. As an aside, a Japanese-style restaurant located in the Shinsaibashi part of Osaka installed one 2hp "Mifujirator" on an experimental basis and it became popular. But customers in a department store in the Nanba part of Osaka showed little interest in the air conditioning equipment on display for use in homes. Leisure facilities accounted for the majority of "Mifujirator" installations, followed by those in use aboard merchant ships and various other types of ships.

Those successes became the background to the installation in February 1938 of "Mifujirator" equipment using fluorocarbon in the Kure Arsenal of the Japanese Navy, located not far from Hiroshima. At the time, Kure was a key naval port facing the Seto Inland Sea. The test operation of the "Mifujirator" equipment, held at the Kure Arsenal, was successful. The equipment was also successfully tested at sea aboard a submarine. General Motors in the U.S., meanwhile, owned the patents in Japan related to producing

Yodogawa Plant, 1952

and using fluorocarbon, and they refused to let either OKK or the Japanese Navy utilize those rights. In the end, in January 1941, the Minister of the Navy in Japan decided to expropriate GM's rights to "Freon" in Japan, and ordered it to be produced locally. Actually, the expropriation was not carried out until right after war broke out between Japan and the U.S. on December 8, 1941.

Production of fluorocarbon at the Imamiya Factory was only 430 kg/month, which made it impossible to meet the rapidly rising demand from the Navy. In that situation, the Navy decided to install and directly oversee the chemical facilities inside the new Yodogawa Plant. After completion of the new plant in July 1942, the chemical facilities in the Imamiya Factory were immediately transferred there, and the plant began producing fluorocarbon. The "Mifujirator" freezers using fluorocarbon were built at the Sakai Plant, and deliveries to the Navy began from there in 1941. Initially, a priority was placed on installing "Mifujirator" equipment aboard submarines and aircraft carriers. Afterward it was installed aboard all newly built vessels. At the same time, the non-military demand for fluorocarbon rose dramatically. OKK expanded the Yodogawa Plant to accommodate demand, and its fluorocarbon production reached 2.95 tons/month in the autumn of 1943 and 4.75 tons/month one year later. Shortages of materials,

Sakai Plant, 1952

however, caused expansion difficulties soon after. And when U.S. planes began bombing Osaka from March 1945, fluorocarbon's production volume dropped sharply.

The No. 2 Imamiya Factory began producing fuses, bullets, and lubricators from June 1934. It was a large plant fitted with the most up-to-date equipment, such as processing machines equipped with motors. The Japanese economy, meanwhile, recovered quickly from the worldwide depression of the time. Following the Manchurian Incident in September 1931 and Japan's subsequent invasion of mainland China, the nation's economic recovery progressed rapidly based largely on military demand. That time coincided with OKK's search for a location for a new plant. Sakai City, meanwhile, located on the coast just south of Osaka, was preparing a large tract of land for industrial use, and that's where OKK purchased land in late1935. The new plant would thus not be very far from the Imamiya Factory. In February 1937, OKK officially named the new plant the Sakai Plant. By 1938, ten buildings were gradually erected, including a forging plant, a repair plant, an office, warehouses, and a dormitory for employees. The production of freezers, fuses, shells, warp tying machines, lubricators, and other items was moved there from the Imamiya Factory. Based on an order from Mitsubishi Heavy Industries, the Sakai

Plant began developing its first new product, a device to fit aboard land-based fighter planes to absorb shocks to the landing gear during take offs and landings.

For some time the plant received orders from Kawasaki Aircraft Industries to produce airplane tail assemblies and various other body parts. Then, in 1940, it received substantial orders from Kawasaki for landing gear shock absorbers, which contributed toward increasing the plant's production of shock absorbers.

Two years earlier, in 1938, OKK received orders from Army Air Force Headquarters for control parts and finished parts for army aircraft. To complete that order, OKK rushed to build another plant for producing aircraft components. It thus purchased 660,000 square meters of wet paddy land northwest of Osaka along the Yodogawa River. That facility was named the Yodogawa Plant. It is still in operation today and includes a chemical plant and a plant producing hydraulic equipment and defense systems. Prior to starting operations there, a trade school was established on the site in April 1940 complete with a training plant for young workers. The first class had 350 workers. Around this same time OKK also established a 5-year trade school and a facility for training technical personnel. Those efforts were aimed at educating young workers in order to cover the severe shortage of technicians. In November 1940, just prior to completing construction of the Yodogawa Plant, OKK moved its headquarters to the mainstay Sakai Plant. Fluorocarbon's production, meanwhile, was moved from the Imamiya Factory to the Yodogawa Plant. The company thus concentrated its main production businesses in the Sakai and Yodogawa plants.

OKK began its all-out production of diesel engines in 1942. The company also began producing Hesselman engines for use in oil exploitation. In October 1943, even as the war situation wors-

ened, those engines were used aboard Army submersibles. The Army, meanwhile, issued a strong directive for increased aircraft production. For its part, OKK built a new plant in Kanzakigawa and began producing airplane tail assemblies there. OKK also greatly increased its production of propeller governors for use with Army aircraft. The quality of the governors was said to relate directly to the aircraft's performance. For its part, OKK practically monopolized the production of hydraulic governors. Also, based on a direct order from the Army, in August 1944 OKK began assembling fighter planes at the Yamatogawa Aircraft Assembly Plant. In conjunction with the increased production to meet military demand, it became necessary to maintain close communication with public offices, and OKK thus also opened an office in 1942 in the Abeno part of Osaka. That office was moved in 1944 to Kitahama in Osaka, and administrative departments such as sales and accounting were moved there from the Sakai Plant. The building in Kitahama was the first building that OKK purchased on its own. Although air raids during the war almost totally leveled the downtown part of Osaka, the OKK building in Kitahama was unscathed.

Because of its experience producing for the military and developing fluorocarbon, OKK was able to establish a strong foundation for doing business in the chemical industry. At the same time, the company's technical expertise for producing machines skyrocketed as well. The technical foundation built through production to meet military demand later served the company well in the postwar period when it switched to meeting private-sector demand. In scale as well, the company expanded its operations steadily after its start in 1934, building plants and increasing production mainly to accommodate military demand. When the war ended in 1945, OKK had grown to become a leading medium-sized

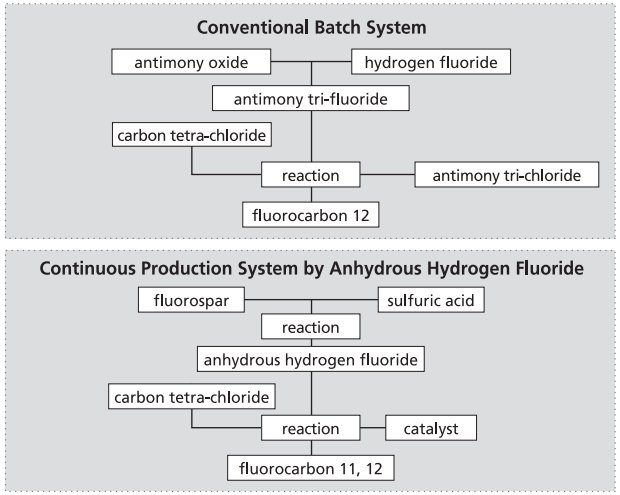
company in Japan's machinery industry. It was listed on the Second Osaka Stock Market in 1941, and that same year its profit versus sales ratio was 24 percent. Observers viewed OKK as a quickly growing, highly profitable company.

In 1930, Frigidaire in the U.S., owned by General Motors, developed a safe refrigerant that included fluorine. In August that year, DuPont and GM jointly established the Kinetic Chemical Company to market the product. They called it "Freon." In 1949, DuPont bought out GM's share in the joint venture. At the time, the product was known worldwide as "Freon". DuPont registered the "Freon" name in Japan in 1953. Daikin, meanwhile, used the brand name "Daiflon" gas (registered in 1961). Though "Flon" is a trademark of Daikin registered in 1960, Daikin informed the Japan Freezer Association that same year that it did not object to the word "Flon" being used as a comprehensive name for the product. Since then, "Flon" is the name that has been used in Japan.

Toward Reopening of Plants after Chaotic Postwar Period

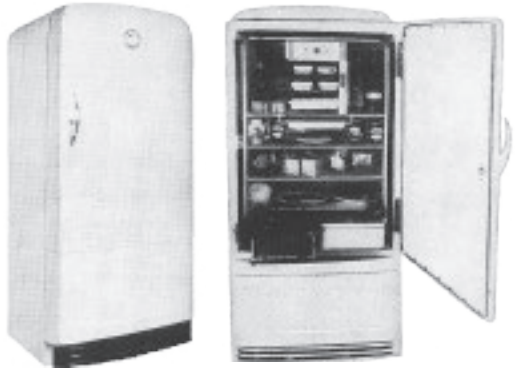
On August 14, 1945, Japan accepted the conditions of the Potsdam Declaration and surrendered unconditionally. The employees of OKK gathered at the Sakai, Yodogawa, Kanzakigawa, and Yamatogawa plants to listen to the Emperor's speech over the radio at noon the following day. The factory managers thanked the employees at each plant for their cooperation. Besides expressing the company's appreciation, the managers promised the employees payment of their salaries and severance pay at a later date. There were 16,500 employees, including 4,800 at the Sakai Plant, 7,400 at the Yodogawa Plant, 1,800 at the Kanzakigawa Plant, and 2,500 at the Yamatogawa Plant. Of that total number, 10,000 were employees of OKK, and 6,500 were students mobilized to work at factories, part-timers, and transfers from other companies. Other than

Outline of Fluorocarbon 12 Production Process



a section of the Sakai Plant producing air conditioners, freezers, and engines for naval vessels, all the plants had gradually turned toward specialized production of artillery shells, bombs, aircraft, and some other military items, and with the end of the war it was impossible to continue production. In late August, the plants laid off all their employees except for a select few to deal with whatever business remained. The Occupation Forces then took over the Yamatogawa and Yodogawa plants, the Tokyo Office, and the Head Office Building, marking a start to the difficult postwar period in Japan.

On August 30, 1945, General Douglas MacArthur and the Occupation forces landed and began establishing U.S. Occupation policies in Japan. In the immediate postwar years, most of Japan's munitions factories used leftover materials to produce pots and pans for use in homes, as well as hoes, sickles, and other farm implements. They also produced a variety of general goods, and moved quickly to adapt to production to meet civilian demand.



Electric Refrigerator for Occupation Forces in Japan

OKK was no exception. Its plants used leftover aluminum alloy and other materials to produce pots and pans, office desks and chairs, and household furniture. Employees, meanwhile, utilized vacant lots on the plant premises to grow vegetables. Though barely subsisting, they made it safely through the difficult postwar period. In October 1945, the Occupation Forces requisitioned the Yodogawa Plant. Only afterward was it learned that OKK was the only company in Japan with the technology for producing fluorocarbon. Subsequently, in March 1946, the Yodogawa Plant received its first order for fluorocarbon 12 from the U.S. military, and in July the plant was returned to OKK. Earlier, in February, the Sakai Plant was permitted to shift to production of consumer goods, and it received orders in April to produce refrigerators for use by U.S. military personnel and their dependents. Afterward, the company gradually added the production of freezers, lubricators, internal combustion engines, and various types of valves. OKK's creative technology turned out to be indispensable in the daily lives of the Occupation Forces. That made it possible for OKK to recover relatively quickly during the chaotic postwar period, and the company shifted production to meet domestic demand.

Sadaji Masuda

Vicious domestic inflation exacerbated the economic difficulties Japan experienced after losing the war. In line with the wartime Law Concerning Companies Supplying the Military, the government compensated Japanese companies that supplied the military for losses they incurred. For that purpose, large amounts of paper money had to be printed. That additional money in circulation served to accelerate the already worsening inflation. In November 1945, GHQ ordered an all-out freeze on compensation to companies for wartime production, and established a new property tax to eliminate wartime profit and set Japan's finances in order. Upon receiving that directive from GHQ, the Japanese government officially decided in August 1946 to end compensation paid to companies that sold products and services to the military during the war. As for corporate losses incurred based on that decision, the government introduced interim measures, such as the Corporate Rebuilding and Reorganization Law. In line with that and other laws, OKK divided its books into old and new accounts, and liquidated its old accounts. GHQ, meanwhile, designated OKK's Sakai, Yodogawa, and Kanzakigawa plants as reparation assets to the Allied Powers. At the time, however, OKK asked that the Yodogawa Plant be removed from that list because it had begun utilizing its facilities to supply the Occupation Forces with fluorocarbon. President Yamada's son-in-law Sadaji Masuda and

other younger employees successfully negotiated with GHQ. Actually, Masuda had been a director in Daido Steel Works but left that company to join OKK. He travelled frequently between Osaka and Tokyo to negotiate with GHQ and Japanese government authorities. Unfortunately, he had a fatal accident on the way back to Osaka from Tokyo in March 1948. He was only 41 years old.

In 1949, the Cold War relations between the U.S. and U.S.S.R. worsened, and the requisition of facilities in Japan as reparations to the Allied Powers was halted. Prior to the halt, four presses from OKK facilities had been removed and handed over to the Occupation authorities. Even afterward, all facilities designated as reparations payments were placed under the supervision of the Japanese government. They were not removed from the reparations list until after the Peace Treaty of San Francisco went into effect in April 1952.

Prior to that, in April 1946, the Yodogawa Plant began producing fluorocarbon 12 for delivery to the Occupation Forces. The plant also obtained permission in September to provide fluorocarbon 12 for civilian use as well, thus allowing partial operation of the Yodogawa Plant. Fluorocarbon 12 OKK delivered to the Occupation Forces was a special procurement and was assessed at a high price. Fluorocarbon 12 was a most important business for OKK and accounted for about half of the company's sales between 1947 and 1949.

GHQ's Occupation policies promoted Japan's democratization. Dissolution of the zaibatsu and agricultural reforms were soon followed by democratization of the labor movement. In December 1945, the Labor Union Law, modeled after U.S. labor laws, came into effect, thus liberating the labor movement from wartime governmental suppression. In OKK as well, labor unions were organized in 1946 one after the other in the Sakai, Yodoga-

wa, and Kanzakigawa plants. Those three unions, plus the Head Office union, joined together to form the OKK Union Alliance. In 1947, the company and the Union Alliance signed a labor agreement.

Even as those events were unfolding, severe domestic inflation struck directly at the daily lives of OKK's workers. Negotiations between OKK and the labor union became extremely difficult. Besides business turning terribly sluggish, in November 1948 the Occupation authorities ended all orders to OKK for refrigerators. Not long after that, OKK introduced its First Business Reorganization Plan, and laid off about 200 excess personnel. At the end of 1948, the OKK Labor Union demanded a special year-end payment, and its members went on strike. OKK responded by locking down all its plants. The two parties eventually reached an agreement in which OKK paid workers a special year-end bonus equal to 150 percent of what the company proposed. Afterward, however, the union was unhappy with the company's inability to recover its business, and the relations between the two parties continued to be confrontational.

Although the fluorocarbon business was vital for OKK's business recovery, in June 1949 the Occupation forces informed the company that it would not be ordering any more fluorocarbon, and would not accept deliveries of back orders. The reason for such a move lay in the nine basic rules GHQ had presented to the Japanese government in order to combat the inflationary spiral of the time. Those rules resulted in GHQ introducing strict restrictions on their own orders for goods and materials. OKK had expanded its facilities to handle large orders from GHQ, and suddenly faced highly adverse circumstances. In that situation, OKK introduced its Second Business Reorganization Plan. Following a severe labor struggle the company laid off 267 workers in September 1949. The company faced a dire financial situation, and was placed under the supervision of the Osaka Bank in 1949. It was also forced to dispose of assets in order to repay its borrowings. While under tremendous financial pressure, OKK could not avoid delays in the payment of employee salaries. The company set itself apart from other companies, however, by never failing to pay their workers, even though payment might be tardy. Such company efforts ultimately led to creation of a relationship of trust between management and labor. After the second round of business reorganization, relations improved further between the two parties, leading to bolstered production.

The deflationary economic policies of Joseph Dodge introduced In March 1950 in Japan brought about a serious economic depression. OKK once again found itself facing the danger of bankruptcy. In response, the company introduced five rationalization items and laid off 250 workers. That was the third time for OKK to lay off workers. As a result, the total number of workers in April 1950 dropped to 438, a reduction in two years to less than one-third the size of the original work force. After experiencing the three layoff periods, Minoru Yamada (later, president) said: "I could not help but be filled with a sense of futility and I felt unsettled. I wondered whether it was proper for companies to continue the cycle of laying off workers when business was bad and hiring them when business was good. My conviction was to make OKK into a company that never again had to restructure itself and lay off workers."

Acquisition of "Freon" Patent

In September 1949, OKK received orders for fluorocarbon 11 from the U.S. military for use on American bases being built on Okinawa. That occasion marked OKK's first production of fluorocarbon

11. In 1950, however, Mitsui Chemical won the bid for supplying the U.S. military on Okinawa with fluorocarbon 12. In April 1951, however, OKK won the bid over Mitsui Chemical by a slight margin of $1.00 per pound. Although DuPont owned the rights to "Freon", special laws were in effect in Japan during the war and those rights were ignored. In August 1949, however, the Allied Powers reinstated DuPont's ownership of "Freon" in Japan. Not long afterward, DuPont contacted OKK about marketing "Freon" in Japan. OKK recognized the great opportunity, and the two companies negotiated an agreement in June 1951 that gave OKK the right to produce and sell "Freon" in Japan. The initial agreement was effective until March 1957, and during that period OKK was the sole company in Japan responsible for manufacturing and selling fluorocarbon.

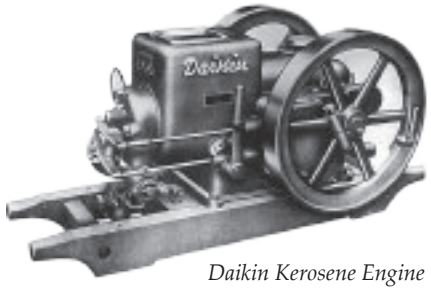
From around the time that OKK obtained the right to produce and sell fluorocarbon in Japan, members of the Occupation Forces started bringing aerosol-type insecticides from the U.S. into Japan. The use of fluorocarbon shifted from use only as a refrigerant to being an aerosol product as well. Refrigerants also gradually shifted away from methyl chloride to fluorocarbon, and the demand for fluorocarbon expanded afterward. In response, OKK started producing fluorocarbon 11, 12, and then 22. The company hired more young workers and assigned them to study and conduct research in the fluorine industry. With a keen eye on the future, this type of forward thinking by the company soon came to life as R&D in fluororesins.

In January 1946, meanwhile, the company in charge of importing goods and materials for the Occupation Forces asked OKK if it could develop an ice-making machine. OKK responded positively to that inquiry, and immediately began designing and preparing a prototype machine at the Sakai Plant. Related to that,

the company resumed production of compressors. OKK subsequently received an order for 55 ice-makers and delivered them in August 1946. Also, after receiving orders for electric refrigerators, OKK developed a mass-production system that started operating from March 1947. November 1948, however, saw the beginning of a reduction in U.S. forces in Japan, and the halting of all new orders for refrigerators. Fortunately, prior to that reduction in forces OKK had begun developing the domestic market for refrigerators and other cooling/freezing equipment. In June 1949, the company delivered freezers to the Telephone and Telegraph Office in Toyonaka, Osaka Prefecture, and the Telegraph Office in Mito, Ibaragi Prefecture. With those sales as a start, telephone and telegraph offices throughout Japan began ordering similar equipment.

One major development that directly contributed to alleviating the difficult postwar food shortage in Japan was resumption of deep-sea fishing. With this came ships built larger and faster, and the development of specialized freezers for storing fish while at sea. The cooling and freezing equipment that OKK developed using fluorocarbon was deemed expensive at first but proved its worth aboard training ships and ships that guided fishing vessels. Demand from shipping and shipbuilding companies increased greatly afterward. Among the best-known customers was Nihon Suisan in 1951 for use aboard the Tonan Maru, a whaling ship, and Osaka Shosen (today's Mitsui O.S.K. Lines) in 1954 for use aboard the Brazil Maru, a passenger ship. Both ships were leading representatives of Japan's commercial vessels at the time. Ships flying foreign flags also used OKK equipment, and fitting ships with cooling and freezing equipment developed into a major business.

To support its overall operations, OKK challenged other new businesses in the postwar period. One such business was kero-



Daikin Kerosene Engine

sene engines used on farms. Japan faced an extremely serious food shortage in the immediate postwar period, and an increase in food supplies was a critical government goal. During the war, OKK had begun researching diesel and Hesselman engines, and engineers at the Sakai Plant tackled the development of kerosene engines, closely following technical specifications obtained from the Agriculture and Forestry Ministry. OKK began producing the kerosene engines in September 1947, and in 1949 consigned their sales to the sales agents of an agricultural tools manufacturer. Consumers appreciated the solid performance of the engines, and their sales gradually improved.

The development of agricultural chemicals was another new business that OKK expected to contribute to the increased production of food. In the immediate postwar period, OKK had turned the trade school at the Yodogawa Plant into a combination agricultural and industrial school. In line with postwar agricultural reforms, however, the land was confiscated. OKK then established the Yodogawa Science Institute, mainly using former staff members of the industrial school as instructors. Based on an idea presented by the school's principal, Masaaki Tokunaga, and encouraged by Professor Yoshiyuki Inoue (father of Daikin Chairman Noriyuki Inoue) of the Agricultural Department of Kyoto University, OKK began the development and sales of agricultural

chemicals. Those operations began in 1948 with a mercury-based agricultural chemical and the selective post-emergent herbicide 2,4-D, but immediately faced difficulties such as product quality and patent problems. In that trying situation the company decided instead to develop fluorine-based agricultural chemicals to utilize basic technology it already owned.

In that way, in February 1950 the company developed a pesticide for killing rats using monofluorine acetate natrium. Called "Furatol", it proved to be a superior product for killing rats in rice fields, wooded areas, and food storage warehouses, thus contributing to Japan's agricultural production recovery. As OKK developed products in the agricultural chemical industry that made good use of fluorine technology, that business expanded to become an important part of the company's overall chemical products business.

A close relationship developed between OKK and the Agricultural Department of the University of Kyoto based on agricultural chemicals, thus opening a new page in the company's technological tradition. At the time, the University of Kyoto boasted of the most advanced research in high-polymer chemistry in Japan. With introductions from Professor Inoue, graduates of the university's Chemistry Department joined OKK and became a strong force in the development of fluororesins. In the identical way that graduates from the Engineering Department of the University of Tokyo joined Minoru Yamada in the old OKK and carried the company forward, the young graduates from the Chemistry Department of the University of Kyoto formed a pillar in the area of chemistry in the new OKK.

In terms of business results, OKK faced continual difficulties in the postwar period. In July 1949, for example, the government approved OKK's Reorganization and Readjustment Plan as a spe-

cial accounting company, thus allowing the company to report extraordinary losses by disposing of assets to cover losses and reducing its capital. As a result, the company's capital was reduced to 45 million yen. Meanwhile, loans from banks increased considerably, and from 1949 to March 1953 the company was placed under the control of the Osaka Bank (later called the Sumitomo Bank; today's Mitsui Sumitomo Bank). Assets that OKK obtained during the war were disposed of and the resultant funds were applied to paying off the bank debt. Of total sales of 512 million yen recorded between August 1946 and July 1949, the Chemicals Division accounted for 55.7 percent of sales and listed profits of 71 million yen. During the same period, the overall company reported a loss of over 23 million yen. Business results during the immediate postwar period fluctuated because of unstable orders from the U.S. military, and sales of fluorocarbon produced at the Chemical Works inside the Yodogawa Plant narrowly managed to keep the company afloat.

In 1950, companies in Japan faced trying financial circumstances related to rampant inflation. In that situation, the Japanese government enacted legislation that allowed companies to reevaluate their assets. In that backdrop, OKK created a reevaluation reserve account that let it to compensate for carried over losses and finally regain normalcy in its accounting system. Around that time, the Japanese economy began to improve in the context of increased demand related to the Korean War that started in June 1950. Business with the U.S. military increased, including sales of fluorocarbon, and OKK's business results finally turned toward recovery. For the period ending in September 1951, the company reported a profit of 5.4 million yen, signaling an end to the long and difficult postwar period. It was as if the sun had started shining again.

Resumption of Business Ties with Sumitomo Metal Industries

The Japanese economy recovered from the misery of the Second World War around 1955, almost exactly ten years after the war ended. Following the signing of the Peace Treaty of San Francisco in 1952 between the Allied Powers and Japan, Japan returned to being a member of the international community of nations. As well, based on the Japanese government's aggressive fiscal policies, business conditions then turned brisk. Riding the wave of worldwide business expansion starting in 1954, Japan's gross national product (GNP) expanded at the highest rate in the world. From around 1955, the substantial production value of many industries in Japan recovered to their prewar levels. In fact, they did not stop with merely recovering to prewar levels but technological innovations led to economic growth and, subsequently, to high economic growth that then continued for over 20 years.

Through the import of technology from other countries, existing industries such as the metals, chemicals, and machinery industries that had fallen behind moved to catch up to their counterparts in the advanced industrial nations of the West. Industries that utilized technology developed during and after the war, meanwhile, such as high polymer chemicals, electronics, and nuclear power, introduced advanced technology and in a single leap modernized themselves. The prewar Japanese economy depended mainly on light industry, and cotton spinning in the top position among all industries, but prolonged periods of capital investment in technological innovation led to great leaps forward in the chemical and heavy industries. Once into the 1960s, exports from the electrical home appliance and shipbuilding industries led an economic upturn, and Japan subsequently caught up with the advanced industrialized nations.

In August 1951, soon after talks began to end the Korean War,

OKK learned that the U.S. military planned to procure artillery shells from Japanese companies. Based on renewed orders for fluorocarbon, OKK was gradually moving toward recovery, but business remained difficult and it viewed orders from the U.S. military as a chance to break from its business dilemma. OKK had experienced difficulties in the past related to the instability of such procurements, but in the context of the challenging circumstances facing the Japanese economy, President Yamada was firmly convinced that the company should accept the orders. He said, "This is the sole chance we have to break through the current situation and rebuild our company." He met with the company's top managers, who were concerned about the danger of accepting orders for special procurements from the U.S. military, and he took the lead in pulling together OKK's overall capabilities while moving forward with preparations for accepting the order. In the end, two companies, OKK and Komatsu Ltd. won the orders. To fill the orders it was necessary to invest at least 150 million yen in new equipment. OKK's main bank at the time, the Osaka Bank, told OKK that the upper limit for any loans was 50 million yen. In the end, OKK borrowed that 50 million yen, and won cooperation from the trading companies handling the raw materials to assume the 10 million yen cost of the materials until after OKK received payment. The remaining 90 million yen needed would be raised through recapitalization. Just about that time, OKK approached Sumitomo Metal Industries (SMI) about renewing the former equity ties they had. SMI was on the verge of postwar recovery, and moved to bolster ties with companies in its former group. OKK, meanwhile, hoped the ties would be the springboard for breaking from the shell of family management and strengthening its corporate foundation. Director Minoru Yamada (eldest son of President Akira Yamada; third president of Daikin) wanted to establish the

ties with SMI and made a proposal at a Board of Directors meeting saying "Rather than depending on old blood, we should inject new blood into the company." Those words expressed his strong conviction that renewed ties with SMI were in OKK's best interest. Meanwhile, SMI's Board members opposed the proposal at first but at the end of August voted to accept it. OKK's Board voted to recapitalize in November, and in the context of the renewed ties, SMI kept 800,000 of OKK's total shares, about 30 percent of the increased capital. Despite OKK's generally unfavorable business situation, investors viewed news of the renewed relationship with SMI favorably and the tripling of capital progressed smoothly.

OKK purchased the material to produce casings for a U.S. military mortar shell order from SMI and Kokura Steel. It produced the fuses at the Sakai Plant, the shell casings and fin assemblies at the Yokogawa Plant, and separately commissioned Nippon Oil & Fats Co., Ltd. (today's NOF Corporation), to produce the explosive powder. In order to make effective use of its limited plant and equipment investment, OKK approached the order for mortar shells by first analyzing the necessary processes, then establishing average processing times, and finally rearranging all the processes to meet the average processing times. For that purpose, OKK introduced innovations and technology to complete its assembly operations, including the improvement of machine tools and specialized jigs. It also developed important technology that utilized high-frequency waves for instantaneous tightening of the mortar shell heads, painting using a conveyor belt, and an electrostatic painting device using infra-red drying. The ability to establish the foundation for production technology based on trial and error efforts in process control and technology development can be called a part of OKK's corporate DNA. Production of the mortar shells progressed smoothly, and the first

prototypes completed in February 1953 passed inspection. OKK completed delivery of all orders, including the additional ones, by December.

The high grades the U.S. military gave OKK for the first order of shells led to further orders, including those for different types of artillery shells. The total reached an amazing 1.7 million mortar shells. One step that OKK took to respond to the military orders for additional shells was extensive expansion of its Yodogawa Plant. Also, in December 1953 the company increased its capital to 270 million yen. The special procurements to the U.S. military, however, ended with deliveries completed in July 1956. Based on OKK's previous experience with the sudden end of special procurements by the Occupation Forces in the immediate postwar period, the ending of special procurements in 1956 was not entirely unexpected. In fact, being able to meet the requirements of the U.S. military in the mid-1950s enabled OKK to improve its production management capabilities in both tangible and intangible ways, such as by cost management, cost reductions, modernization and rationalization of production facilities, and delivery management. The company also grew rapidly in size: its capital in 1956 was 600 million yen, and it had 2,000 employees. In 1954 its rate of dividends payments was 20 percent, making it an outstanding corporation.

Management of the large-scale business that accompanies rapid growth could not be accomplished by the methods in place at the time. It became essential for OKK to introduce business reforms, including new internal organizations, new labor relations, the rationalization of administrative work, and the education and training needed to develop human resources capable of responding to new technology. In November 1952, Hiromu Kasuga was elected chairman of the board of OKK, and Yoshio Tsuchiya was

elected senior managing director. Both men had been seconded from Sumitomo Metal Industries, and they were crucial for introducing modernized American-style business management technology to OKK's operations. The main emphasis of the reforms was strengthening top management, and to that end a series of measures was introduced, including the holding of regular board meetings, establishing a modernized control organization, and clarifying management's authority and responsibilities. At the time, moreover, because there was much work that required tough price controls it was necessary for employees to have a sharper awareness of what price controls meant. OKK studied this matter thoroughly and introduced many new ideas to its employees.

During that period, meanwhile, OKK developed two advanced products. One was air conditioners from the freezing equipment division and the other was fluororesins from the fluorine-chemical division. Although the end of orders from the U.S. military affected OKK negatively, the influence on the company was minimized by its ability to switch gears consistently to meet private-sector demand.

From the second half of the 1950s, the Japanese economy entered a period of high-level growth, best described in the government's annual economic white paper as "Investment begetting investment." Based on plant and equipment investment, technological innovations progressed rapidly. Volume production of new products and automation of production were the two main factors supporting that growth. Based on those two factors, home appliances such as television sets, electric refrigerators, and electric washing machines were supplied in large volumes at low prices. The daily lives of ordinary Japanese people changed in a short while and became more sophisticated. Amidst high-level economic growth, wages and income rose and both became standardized.

Under the slogan "The consumer is king," a society emerged based on mass consumption.

OKK's products were not necessarily aimed at mass consumption, but in response to business trends the company switched its focus to consumer demand and modernized its management. OKK established a comprehensive budget system and was soon benefitting from it. From 1959, the company focused on improving production management and quality control management by forming study groups on production control methods and establishing QC circles. From 1960, management and labor representatives met regularly for discussions, using the occasion to have labor union perspectives reflected in management. It was around this time that labor councils began appearing in Japanese companies, a system that contributed significantly to the maturing of labor-management relations, to the greater democratization of management, and to closer cooperation between labor and management.

In January 1960, moreover, OKK established a long-term business plan that aimed at doubling the company's labor force to 5,000 workers by the end of 1964, tripling the company's capital to over 5.4 billion yen, and increasing sales five-fold to 25 billion yen. In the backdrop of the highly favorable business conditions that continued from 1959 to 1961, the company's financial results during the first half of the long-term business plan proceeded smoothly. From July 1961, however, the government introduced a tight money policy, and business conditions turned sluggish. In that new situation, the company's total sales languished, reaching only 75 percent of the business plan's goals.

As the company shifted its sales goals in the postwar period toward meeting private-sector demand, its mainstay products became widely diversified, including fluorochemical products, vinyl

Party to Celebrate Name Change of Company on 40th Anniversary

chloride construction materials, air conditioning and refrigerating equipment, agricultural machinery, and products related to hydraulic equipment. Although the company's sales network expanded to cover all of Japan, meanwhile, the company's official name continued to have "Osaka" in it. The Osaka name seemed to be negatively affecting sales in the Kanto area, including Tokyo, the company's largest domestic market. Actually, the name Osaka Kinzoku Kogyo Co. had been shortened to "Daikin," and it was often used as the company's trademark, such as in Daikin Airconditioner. In 1963, on the company's 40th Anniversary, its official name was changed from Osaka Kinzoku Kogyo Co., Ltd. (OKK) to Daikin Kogyo Co., Ltd. (changed again in 1982 to Daikin Industries Co., Ltd.) Unifying the company name and trademark was a good PR move, and achieved the overall objective of raising the company's corporate image.

With the new name, Daikin also broke from its image of being a family company. In January 1965, President Akira Yamada, the founder of Daikin, assumed the company's chairman position, and Executive Vice President Yoshio Tsuchiya became president. Tsuchiya entered Daikin from Sumitomo Metal Industries as senior managing director, and for 13 years he was at President Yamada's right side, handling important responsibilities such as


Chairman Akira Yamada (left), Second President Yoshio Tsuchiya (right)

modernizing the company's business. After assuming the presidency, Tsuchiya exerted even greater reform efforts in two areas. One was the company's withdrawal from the unprofitable agricultural machinery and construction material businesses. Daikin entered the agricultural machinery business in 1947 and for close to twenty years realized solid profits. The company's construction materials business, meanwhile, began in 1947 when Daikin was supplied with materials from Sumitomo Chemical and commercialized vinyl chloride pipe. From the mid-1960s, however, many other manufacturers entered these two businesses and competition heated up dramatically, leading to a sharp drop in prices and worsened business results. Daikin decided to withdraw from these businesses around 1970. At that time, the company did not call for early retirements and did not lay off any employees. Instead, the company concentrated its personnel and capital investments in the air conditioning and other machinery divisions, two areas experiencing considerable growth within the company. By doing so the company aimed to strengthen its overall structure.

Daikin's second major business reform was the introduction of a new system of labor affairs management. Labor and management relations were confrontational and strained in the past but after the company overcame its management crisis in 1952, the two groups established and maintained a cooperative relationship. After the Osaka Kinzoku Kogyo Federation of Labor Unions was established in 1951 (reorganized as Daikin Roren in 1960), labor and management built a new system of cooperation that centered on agreements reached at the Labor Management Council. The supply of special procurements to the U.S. military and the smooth transition toward meeting private-sector demand, as Akira Yamada later said, "… were accomplished only because of the vigorous cooperation of the labor union." In the second half of the 1960s, management proposed and subsequently introduced a system of monthly salaries for all employees, abolished the time card system in 1968, and as a measure prior to introducing a five-day work week, the company introduced a system of not working on designated Saturdays. A qualification system was introduced next, in 1969, as a first step toward adopting a performance-based personnel system. Qualifications were linked to job evaluations, leading to a new system of wages that considered both job evaluation and the seniority system. These human resources and labor management systems were quite progressive when compared to the systems in Japan's major corporations at the time. Minoru Yamada, director at the time and later president, was responsible for building those systems. Yamada was widely recognized for his strong character and insightfulness. From 1970 he served for many years in the Kansai Association of Corporate Executives (KACE) as chairman of the committee on labor issues.

Introduction of the foregoing systematic measures, however, did not mean that labor/management relations turned completely amicable. In divisions such as agricultural machinery and construction materials, where business turned unprofitable and production was halted, workers were reassigned to new jobs, leading to instability in the work environment. As is the fate of chemical plants, society grew more critical of environmental pollution

caused by mishaps in the manufacture of fluorocarbons, and nearby farmers began to intensify their demands for compensation. Such events caused distrust in management to develop among employees. For its part, the labor union was unable to fully grasp the developments. From 1965, the Vietnam War and the second revision of the Japan-U.S. Security Treaty caused a movement to spread among students and young workers protesting the war and criticizing the political party in power. Mirroring the events in society, the Democratic Youth League called on young workers in the Yodogawa Plant to organize and block the production of artillery shells, causing labor regulations to lose their effectiveness. As well, anti-war demonstrations were held on the plant grounds by non-Daikin protestors, escalating the feeling of uneasiness among the company's employees. Daikin moved to resolve these various problems from around 1966. Heading that move was General Affairs Section Manager Noriyuki Inoue (today's Chairman). Inoue's first step was to improve communication with young workers at the Yodogawa Plant. He listened to what made them uneasy at work and to dissatisfactions they had, and then moved to resolve their problems, thus also promoting the normalization of labor union activities at the Yodogawa Plant. Inoue also worked closely with the local community to respond sincerely to grievances related to accidents at the plant. Meanwhile, although Daikin normally guarded its plants closely against visitors, Inoue arranged to open the grounds to the local community for plant tours and for summer festivals, including Bon Odori Dancing. In these and other ways, Inoue steadily promoted mutual understanding between the company and local residents. Anti-war protests, meanwhile, passed their peak around 1969, and labor and management relations at the Yodogawa Plant began moving toward a resolution. The anti-pollution measures that remained,

Bon Odori Dancing Festival at Yodogawa Plant

however, had to wait until after 1970 for implementation. Even as the Oil Crisis worsened, affecting business negatively, Daikin allocated 13 percent of its total investments toward controlling wastewater and emissions.

In 1964, Japan became an Article 8 member of the International Money Fund (IMF) and joined the Organization for Economic Cooperation and Development (OECD), thus winning recognition as a member of the international community. Next, from the mid-1960s Japan entered its second stage of high economic growth, and its GNP became the second largest in the world next to the U.S. On the one hand, Japan was valued highly in the international community because of its rapid growth. At the same time, however, it became the object of international bashing. Additional time was thus needed before Japan could be truly evaluated as an advanced industrial nation. Domestically, meanwhile, Japan's rapid industrialization contributed toward realizing an affluent society but also led to distortions that developed into social problems. A series of court cases related to environmental pollution, establishment of the Environment Ministry, and the popularity of the consumer movement fueled widespread criticism of large corporations. In response to those social changes, in November 1970 Daikin announced its Second Seven-Year Long-Term Busi-

ness Plan. Under the theme of "Challenging Change in the 1970s," the plan listed seventeen items that required attention, including the direction in which the corporation should grow, the development of human resources, cost reductions, establishing a business management information system, and preservation of the environment. For 1977, the plan's final year, Daikin established numerical goals of 200 billion yen in sales, ordinary income on sales of 8.5 percent, and a total of 7,700 employees. Actually, however, with the so-called "Nixon shock" of August 1971 as a turning point, the yen was evaluated upward and business languished, thus frustrating Daikin's long-term business plan. Total sales in 1972 were under 60 billion yen, and the company's profit ratio dropped from 7.7 percent in fiscal 1970, the year the plan was introduced, to 4 percent in 1972. The curtain thus rose on a period of tribulations for Daikin.

Akira Yamada, the founder of Daikin, passed away in February 1973 at the age of 88. As the company's third president, his eldest son Minoru had assumed the company's presidency in 1972, and President Yoshio Tsuchiya had become chairman. In the Preface to his autobiography, Yamada said, "My life was the life of an individual at the same time that it was the life of a company called Osaka Kinzoku Kogyo." It was exactly because Yamada was always able to make bold and rational decisions when facing important situations that he was able to build the foundation for Daikin. That was also why he was able to cultivate for many years a corporate culture filled with a venture spirit.

Establishing Foundation for Air Conditioning Business

The "Mifujirator" that Osaka Kinzoku Kogyosho (OKK) developed in 1951 was Japan's first packaged type air conditioner. In the postwar years, the Ministry of Electric Communications (MEC;

Daikin's First Packaged Air Conditioner, 1951

later became Nippon Telegraph and Telephone Public Corporation [NTTPC], privatized in 1987 to become today's NTT) was conducting the most advanced research into temperature and humidity regulators. OKK was providing MEC with cooling equipment and was benefitting to the fullest by advertising that fact widely. The company also supplied government offices and the private sector by selling and installing cooling equipment for central systems, and heat-pump type cooling and heating equipment. In the fall of 1950, the Japanese economy began breaking from the Dodge Line-related inflation, and a demand for heating and air conditioning equipment emerged from theaters, high-end Japanese restaurants, and other places. But large-scale centralized heating and air conditioning equipment was expensive to install and to operate. A need thus arose for simpler, packaged air conditioning equipment. Besides the freezer equipment from OKK, the Ministry of Electric Communications also imported packaged air conditioners made by Chrysler in the U.S. and installed them in the Honjo Telephone Office in Tokyo. Inspired by the new technology in this packaged air conditioner equipment, OKK immediately established a group headed by Chief Designer Hiroshi Fujioka in the Design Section of the Sakai Plant, and began developing a packaged type air conditioner. In May 1951, the group completed

development of a high-speed compressor first and then a packaged type air conditioner. The first prototype was displayed in the cafeteria of the Osaka Gas Building in Hirano-cho, Osaka, and drew widespread interest.

In 1952 Mitsubishi Electric, and in 1953 Hitachi Ltd. and the New Mitsubishi Heavy Industries, all began producing packaged air conditioners, leading to intensified competition in the domestic market. OKK had previously been supplying NTTPC with central air conditioning systems, but won an order for packaged air conditioners in 1953 for installation in a telephone relay station in Fukuoka Prefecture. That marked the first time for NTTPC to switch from central air conditioning systems to packaged air conditioners. Afterward, OKK products came to account for 70 percent of all air conditioners that NTTPC installed. NTTPC's stringent inspection process contributed much toward improving OKK's air conditioning technology. For compressors, OKK used the Chrysler air conditioner compressor equipment in U.S. military facilities in Japan as a reference, and in 1953 developed a semi-hermetic type in which the motor was mounted inside the compressor casing. Compared to the open type, the semi-hermetic type had less vibration, operated more quietly, and had fewer maintenance problems. Air conditioners marketed in the following year with the semi-hermetic type compressors proved to be popular. R-12 was used as the refrigerant for the 5 hp motor and the more chemically active R-22 was used for the 7.5 hp motor. Because the latter caused more accidents, a side-type hermetically sealed compressor was developed for using the R-12 and it was mounted in 7.5 hp air conditioners. It took 4-5 years before R-22 appeared again. Because of the error in shifting to R-22, the production of compressors was short-lived. Such trials and errors, however, were a first step in technological innovation toward developing a hermetic-type compressor.

Another major air conditioning market that emerged around this time on a par with NTTPC was banking. The Sumitomo Bank and The Sumitomo Trust & Banking Co., Ltd., in particular, were in the same Sumitomo Group and gave priority to OKK in their procurement of air conditioners. Sales also increased to banks in other groups. There were few sales agencies in Japan at the time and most of the company's business was directly with customers. Following the increased sales to banks, business with trading companies expanded, boosting OKK's sales capabilities in the air conditioning field. OKK then quickly took steps to bolster its air conditioning sales organization. In 1956, for instance, OKK selected 52 dealers it was especially close to among those providing air conditioner services, and not long afterward sponsored the First OKK Dealership Convention. The company also contracted with "super dealers" that had nationwide sales networks covering Japan's major cities, thus in a single step expanding the company's sales network to cover the entire country. During the business slump in 1965, however, OKK shifted to a policy of working with special dealers designated as important agents. The company also nurtured new types of agents with design and service capabilities related to the installation of air conditioning equipment, so-called specified sales and installation agents, and agents with trading company functions, such as those conducting wholesale sales. The first such agent was Joyo Daikin Airconditioning Company. Later, other such sales companies were established that also used the wording "Daikin Airconditioning Company" in their names. These were combination dealers and special installation offices. The ten such "special" dealers who emerged by 1972 became key companies in OKK's sales network.

In Japan's first period of high-level growth, changes were

"Cab Cooler" Airconditioner

seen in the demand for freezers. In terms of existing freezers and refrigerating equipment aboard ships as well, a demand emerged for equipment that also controlled temperature and humidity, and cooling and heating. Even in the area of freezing equipment for use in plants, a variety of needs emerged. One such need was for extremely low temperature equipment. In 1952, OKK developed a two-stage compression type device capable of cooling to -45 degrees C. It was delivered to Nihon Suisan's freezing plant. With this as a turning point, OKK received numerous orders for ultra-low temperature cryogenic units, from -40 to -70 degrees C, from the steel and chemical industries. Standards were set for that unit, called "Sub-zero", in 1954. The new product's capabilities expanded rapidly, including for use in tests of metal, rubber, and plastic materials, the freezing of blood plasma and penicillin, the rapid freezing of food products, and the cold storage of chemicals and medicines. An air conditioning unit was also developed for use in the cabins of crane operators. Called a "Cab Cooler" when it was introduced, many units came to be used in the cabs of ceiling cranes in steelworks.

In the medium-size air conditioning equipment market, sales increased for small chillers and single-unit packaged air conditioners for use aboard ships and in plants and large warehouses.

OKK held such a strong position in the market for ai conditioning equipment used aboard ships that no other company could compete effectively. In 1965, for example, OKK installed cooling and freezing equipment aboard the Fuji, the first Japanese ship—a Maritime Self-Defense Forces ship—to participate in new expeditions to the Antarctic. During the shipbuilding boom in Japan around this time, many merchant ships installed Daikin air conditioning equipment. Also, together with the increased use of containers, OKK won an order from Nippon Yusen Kaisha (NYK) in 1967 for refrigerating equipment installed in seagoing containers. The containers were to be stored aboard the Hakone Maru, NYK's first full-container vessel. Other marine transportation companies followed suit and OKK received many orders for similar equipment, making refrigerating units for reefer containers a mainstay product. Demand also emerged for air conditioning equipment aboard buses and freezing equipment aboard trucks. OKK actually developed a wide variety of products, including low-temperature containers for sale to cold chains for storing and transporting vegetables. In these ways, OKK used middle-size and small air conditioners to build a solid business foundation.

At the time, meanwhile, the demand for large air conditioning equipment, as represented by turbo freezers, was steadily increasing in the backdrop of a construction boom for larger and higher-rise hotels and office buildings. But OKK was late in entering this business. Its first product was a large-size turbo freezer it installed in the Ibaraki Plant of Sumitomo Chemical in 1962. While other companies had already developed hermetic-type air conditioning equipment, OKK's products were open-type and did not provide adequate performance. OKK barely secured a foothold in the turbo freezer market. Between the second half of the 1960s and the early 1970s, on the occasion of the Olympics being held in

3,000-Ton Turbo Freezer

Tokyo in 1964, there was a building construction rush. Centered in and around Tokyo, large buildings with underground parking lots were being built one after the other. One result was that air conditioning equipment was located on the roofs of buildings, and the demand was for small-size, lightweight equipment. OKK was late in entering this market and in order to respond quickly to the emerging demand the company in 1964 entered into technical ties with Worthington Corporation of the U.S. and introduced technology for developing a small, light, hermetic-type turbo unit that produced little vibration or noise and was simple to operate. Worthington was ranked among the world's top manufacturers of centrifugal chillers and owned original technology. Through the technical ties with Worthington, the performance of OKK's turbo freezer improved greatly and sales quickly increased. In 1966, OKK built a plant inside the Kanaoka Plant and prepared a system for volume production of the turbo units.

At Expo '70, the World Exposition held in Senri, Osaka, in 1970, OKK installed a 3,000-ton open-type centrifugal chiller for the Festival Plaza, the main gathering spot at the exposition, fitted with a 30-meters-high roof. That success secured OKK's name in the market for industrial-use centrifugal chillers. A year later, in

1971, OKK entered into technical ties with Frigo Scandia Contracting of Sweden related to a device for the rapid and continuous freezing of food products. OKK also entered into technical ties with Bolsig Co. of West Germany for a low-temperature absorption-type freezer plant. Although OKK aimed to catch up technologically in the area of large-size freezers, its actions did not produce the desired results.

Sales of products in OKK's air conditioning division, its leading products at the time, increased about 20-fold between 1955 and 1964, Japan's first high-level growth period. Later, between 1965 and 1972, Japan's second high-level growth period, sales increased again about 5-fold. The Sakai Plant, where the air conditioners, freezers, and heating equipment were being produced, experienced a greater diversification of production, related mainly to an expanded demand for air conditioning. Also, because of an increase in the size of products, such as turbo-type freezers, the plant was continually expanded and new equipment installed until it reached a point of saturation. In 1960, therefore, the company decided to build a new factory for producing cooling and heating equipment, and for that purpose purchased 96,000 square meters of land in the Kanaoka-cho, Sakai City, Osaka. In November 1960, OKK increased its capital to 3 billion yen, and in November 1961 increased it again to 5.5 billion yen. The first stage of construction of the new plant, the Kanaoka Factory, was completed in December 1962 and the start of operations there served to increase 1.5-fold the company's capabilities for producing cooling and heating equipment. In the middle of all this activity, the company changed its name in 1963 to Daikin Kogyo Co., Ltd. ("Daikin"). In 1966, Daikin also moved the production of turbo equipment to the Kanaoka Factory and in 1967 expanded the production capabilities there to about triple the plant's original capabilities.

During Japan's first stage of high-level growth, the market for home electric appliances expanded greatly, including television sets, electric refrigerators, and electric washing machines, at the time called the "Three Sacred Treasures." OKK aimed to enter the home appliance market and to that end developed various products. In particular, because sales of its mainstay products such as air conditioners and freezers tended to be concentrated in the summer months, OKK also aimed to standardize its production by developing and marketing small-size heaters for use in homes. In the second half of the 1950s, most Japanese homes used traditional heating equipment such as kotatsu (a traditional Japanese heater used under a table) and hibachi (a charcoal brazier) in the winter months. Air conditioners and gas stoves were not yet used widely. In that situation, OKK developed and sold a gas fan heater in 1958 that blew warm air to heat a room. As a small heater for use in homes, this gas heater was the first ventilation-type heater used in Japan. From the outside, the modern design looked much like a television set; its body was red, and the grill and hot air exit were cream colored. It was an innovative product for its time. To increase sales of the gas heater, OKK entered into a sales agreement with Matsushita Electric in 1959. Sales, however, failed to expand. The cause of the poor sales performance was an ineffective customer service system. Ordinary homes in Japan at the time were generally drafty and it was difficult to heat an entire room. That led to so many customer complaints that production of the heater was halted in 1961. Actually, the product was too early for its time, much as OKK's hand dryer was too early in prewar Japan. But OKK can be evaluated highly for its optimistic posture in developing new technology.

During the second half of the high economic growth period, three of the main durable consumer products that ordinary Japanese were purchasing were color TV sets, air conditioners, and automobiles. OKK began producing a window-type air conditioners in 1958 but the company's sales agencies at the time were concentrating their sales activities on commercial-use air conditioners and they were ineffective in their sales approach to ordinary households. In that situation, OKK, besides its own brand, provided the window type to OEM for Japan's four largest manufacturers of household electric products, all of whom had their own sales networks for approaching ordinary households. OKK's window-type air conditioner was the first such product that used a rotary compressor, and sales personnel emphasized the product's small size, light weight, dual use for ventilation, and ease of operation. Initial sales progressed smoothly. After a while, though, customers began complaining and the product's price had to be lowered, leading to decreased profits. In 1966, Daikin (name changed to Daikin in 1963) halted sales to the four electric products companies, and reduced production of the window-type air conditioner. At the time, the spread of air conditioners for use in homes had not reached 3 percent. But Daikin saw an increased demand for room air conditioners in the future in Japan and decided to move all out in the market. For that purpose the company built a new plant in 1967 to produce only air conditioners for

Shiga Plant Around Beginning of Operations, 1970

homes in an industrial park in Kusatsu City, Shiga Prefecture. Completed in 1970, the modern Shiga Plant was totally rationalized, and included a conveyor belt system for mass production of home-use air conditioners.

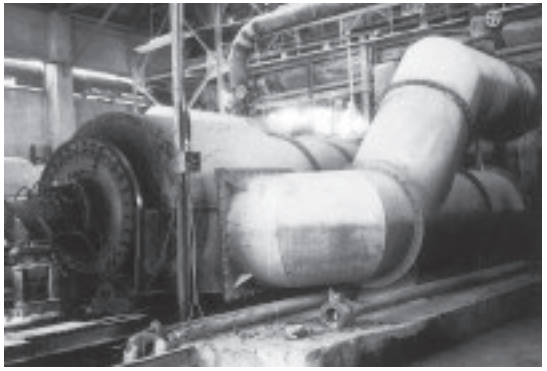
Back in 1965, meanwhile, Daikin produced a small-size, high-performance window-type air conditioner at the Sakai and Kanaoka plants, fitting it with a compressor based on technology it previously imported from Whirlpool in the U.S. The consumer magazine "Kurashi no Techo," known widely for its fair testing of commercial products in Japan, including imports, tested Daikin's product and various other air conditioners, and evaluated it as an A- class product. That improved the brand image of Daikin's air conditioners and led to increased sales. In 1972, moreover, Daikin introduced an innovative multi-room air conditioning system that when mounted outdoors cooled several inside rooms at once. Sales of the product were explosive. Daikin also developed and began marketing in 1970 a home-use combination heater/air conditioner that utilized a refrigerant heater for which Daikin held patents in eight countries. Other companies had similar double-use equipment but their products caused many accidents, which led to a halt in production. Daikin's product, on the other hand, utilized a unique mechanism and caused no problems. It was also power efficient and it continued to sell well. In such ways, Daikin was successful on its second entry into the air conditioning market.

Concerning heaters as well, Daikin developed a variety of products, including a hot water fan blower, a water boiler, and a system boiler, expanding the market from the previous commercial-use machines to those used in ordinary homes. The percentage of heating and hot water central systems used in ordinary homes in Japan was still low but Daikin viewed them as promising next-generation products and promoted the development of a variety of products.

Although Daikin played a pioneering role in the air conditioning field in Japan, its production and sales efforts failed in the areas of drinking water coolers, Japanese tea coolers, and other products used in homes. Even in the company's principal business of air conditioning, competition heated up and other home electronic product manufacturers that turned into major corporations developed high technical capabilities, forcing Daikin into heated competitions. Especially in the field of technical development of hermetic turbo freezers and absorption-type freezers, Daikin lost out to other companies. The Daikin products that had competitive power were chillers and small and medium-size freezers. By building a firm foundation in those areas, Daikin was able later to succeed in the packaged air conditioning field.

Evolution of Fluorine Chemical Technology, and Development of Overseas Markets

Daikin's main business pillar during Japan's period of high-level economic growth was the air conditioning business. From about the mid-1950s, however, fluorine chemicals emerged and gradually propelled the company's growth. In fact, it was around this time that Daikin fashioned its current business structure, with air conditioning and chemicals as its two main pillars. The demand for fluorocarbons began increasing rapidly from 1953, the same year that Japan's home electric appliance manufacturers began switching the refrigerant they used in refrigerators from methyl chloride to fluorocarbon. By 1955, they accounted for 90 percent of all refrigerants used. Besides CFC11 and 12 used as refrigerants—and used with aerosols—two new products, CFC22 and 113, were introduced in response to the diversified needs for use in large



Rotary Kiln for Producing "Daiflon" in Continuous Reaction Process

freezers and as cleaning lotions for semiconductors.

Major innovations were introduced in the production of fluorocarbons. In prewar years, CFC11 and 12 were produced using the batch method with antimony oxide and hydrofluoric acid as the raw materials. Because Daikin procured those chemicals outside the company, it was difficult to reduce prices. In that situation, Daikin began researching how to make changes to produce anhydrous hydrofluoric acid from a continuous response from fluorite. The company had to handle the acid carefully, however, because it was toxic and highly corrosive, and there were also problems related to handling the strongly adhesive gypsum created as a by-product. But through cooperation between the company's chemists and the equipment technicians the difficulties were overcome and volume production of anhydrous hydrofluoric acid began in 1954. Besides reducing production costs considerably, the quality of the "Daiflon" gas (Daikin's product name for fluorocarbon) was stabilized, a problem area since the days when Daikin was doing business with the U.S. military in Japan. The technology Daikin developed at its Yodogawa Plant for continuous production was highly advanced for its time, and combined with the industrialization of fluororesins Daikin won the Seventh Mainichi

Industrial Encouragement Award. The anhydrous hydrofluoric acid was not only used in-house for producing "Daiflon" gas but was increasingly sold externally for uses such as for refining uranium and etching semiconductors. Concerning "Daiflon" as well, in 1963 when the problem of aerosol's combustibility surfaced, Daikin developed and marketed Airflon, a gas combining fluorocarbon and butane. Sales of Airflon expanded quickly.

In March 1957, after DuPont's Japanese patent ran out, Nitto Chemical Industries began producing fluorocarbon, marking the start of a period of competition among fluorocarbon manufacturers, although Daikin continued to hold an overwhelming market share because it was the first company to market it. Besides Nitto Chemical, Asahi Glass also applied to the government to import technology from overseas. The Ministry of International Trade and Industry (MITI) was promoting powerful industrial policies at the time, and did not hesitate to take the lead in developing Japanese industry. Based on the anti-monopoly law, it aimed to improve the monopolistic situation regarding fluorocarbon. At the same time, MITI also considered contributing to the improvement of Japan's foreign currency position, in effect killing two birds with one stone. It thus recommended that Daikin provide Asahi Glass with fluorocarbon technology. In 1962, based on that recommendation, Daikin and Asahi Glass agreed to technical ties, thus introducing a period of fluorocarbon competition among three companies.

Meanwhile, DuPont was successful as early as 1945 in industrializing Polytetrafluoroethylene (PTFE). It was called "Teflon", and DuPont began producing it commercially from 1950. Daikin, meanwhile, used "Daiflon" 113 as the raw material and successfully developed PCTFE (product name "Daiflon"), and in 1955 also successfully developed PTFE. It then began selling molding pow-

der. The price for domestically produced molding powder was very high at 7,000 yen/kg. In comparison, the starting salary in banks for a university graduate was 5,600 yen/month. The major U.S. companies Kellogg and DuPont had worked with fluorochemicals, and found that product quality was not the only problem: price competition was also intense. In order to defeat its competitors, Daikin knew it was necessary to expand the use of this new resin and to reduce cost based on volume. Fluorocarbon, however, was entirely new and much of its molding technology was still undeveloped. Daikin, meanwhile, had in-house molding facilities and researched and developed related technology on its own. It also nurtured and guided other companies starting in the business. In 1954, Daikin organized a group to study fluororesins with the fluororesin processors. The group received subsidies from MITI's Institute of Advanced Industrial Science, and studied production and processing technologies and applications. Daikin not only received an award from the Mainichi Newspaper for its industrialization of fluororesins in 1955, but it also received the Third Agency of Industrial Science and Technology Director- General's Award in 1956. Even at that point, however, numerous issues remained related to the practical application of fluororesins, including improvement of production processes and development of molding technology. Next, in 1958, a group of companies centered on Daikin, proposed official standards for the plastics industry to be disseminated by the Japanese Industrial Standards (JIS) organization. Daikin also played a key role in establishing molding technology and standardizing products. As well, in 1962 Daikin played a prominent role in establishing the Japan Fluororesin Industry Association and spreading the use of established standards.

In April 1955, Daikin successfully developed tetrafluoride ethylene chloride, calling it "Polyflon", and began its all-out production. Together with "Daiflon", meanwhile, the company also began selling fluororesins, eventually turning those sales into a profitable business. "Polyflon" competed with "Teflon", produced by Mitsui Fluorochemicals using technology it imported from DuPont. Then, in 1959, a third company, Nitto Chemical, developed and marketed a similar product it called Tetraflon", leading to competition in the Japanese market by Daikin, Mitsui Fluorochemicals, and Nitto Chemical. Daikin's capabilities for developing technology and its many business successes, however, were recognized internationally. In 1963, for example, Daikin provided the technology for producing "Polyflon" to Thiokol in the U.S., and the technology for producing "Daiflon" gas to Racon, also an American company. At the time, Japanese manufacturers still relied mainly on the import of technology from companies in Europe and the U.S. In that situation, to have a Japanese company export fluorocarbon technology to the U.S., fluorochemical's birthplace, can indeed be called a significant event.

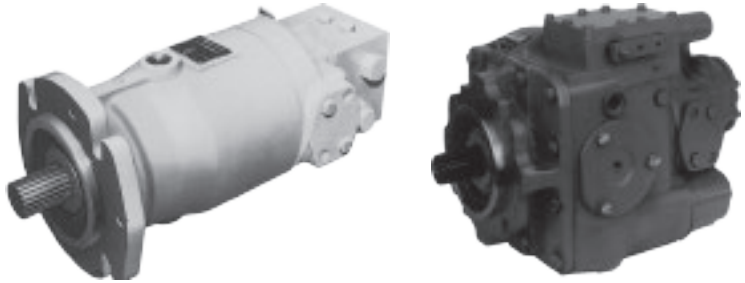
Products Made from "Polyflon"

The year 1963 also saw Daikin successfully develop technology that proved to be a turning point for the rapid growth of its fluororesin business. The technology was developed jointly by Daikin and Professor Haruo Shingu of the University of Kyoto. It differed from the dry method of Du Pont and marked the first

FU-25L Centralized Lubrication Device

time in the world for producing "Polyflon" using the superheated steam method. Daikin applied for a patent in that same year and began producing "Polyflon" from 1967. At the time that "Polyflon" was being developed, fluoropolymers were still highly expensive. Because of the successful development of "Polyflon", however, much lower prices became possible, and a firm business base for the product was finally established. Around this same time, ICI in England filed a protest against Daikin's "Polyflon" patent, but it was struck down.

The diversification of business, using high-level economic growth as a springboard, also applied to the oil equipment business. In December 1949, Hirohata Works of Fuji Steel (later Shin Nihon Steel; today's Nippon Steel and Sumitomo Metal Corporation) requested OKK to repair and replenish OKK's "Rational Lubricator(s)" and imported lubricating devices in strip mills made by Furval Lubrication System, Inc., of the U.S. Based partly on a suggestion by Hirohata Works, OKK developed a completely automatic Furval-type centralized lubrication device. Taking advantage of the boom at the time in constructing water-generated power stations, the company monopolized sales of the lubrication device for supplying oil to a water mill used for generating electricity. Together with the company's oil pressure equipment, the



Hydraulic Transmission: Piston Motor (left) and Piston Pump (right)

lubrication device became a mainstay product in the Oil Equipment Department. In 1953, meanwhile, one lubricating device related to an order OKK received from Kawasaki Works of Nihon Kokan (today's JFE Steel Corporation) was able to reuse previously used oil. Based on that device, OKK developed an improved "forced circulation" oil supply device. It was around the mid-1950s that companies in the steel and paper industries were earnestly investing in the rationalization of their manufacturing equipment. OKK won many of those orders and its sales expanded quickly.

As the demand for Japanese hydraulic equipment increased rapidly, influential overseas manufacturers entered the Japanese market and competition heated up. In addition, since by its nature the industrial equipment field was quickly affected by changes in business conditions, sales decreased in the context of the business recession in the mid-1960s. So it can be said that the industrial equipment field was not stable at that time. In that situation, Daikin (name changed from OKK in 1963) promoted market development in industries other than steel and developed new products. Concerning hydraulic transmissions, for example, in1968 Daikin and Sundstrand Corporation (today's Sauer-Danfoss) signed an agreement for importing technology into Japan. Sundstrand was

the top manufacturer of transmissions in the U.S., and while Daikin paid dearly to introduce Sundstrand's technology into Japan, the times were a period of high economic growth and the market demand was robust for large-size cranes and other vehicles used in the construction industry, including also construction machinery, and industrial-use vehicles and machinery, providing Daikin the opportunity to enter a new field.

Japan's private trade reopened in 1946, while the country was still occupied and generally administered by GHQ of the U.S. Daikin turned to its first postwar exports in the early 1950s, comprising kerosene engines and small-size diesel engines developed for agricultural machinery and sent to the Philippines, Taiwan, and Brazil. The first export of air conditioners was for orders received in 1954 for 150 units of the compact 2hp air conditioner to be sent to Myanmar as part of Japan's war reparations. The first exports of the mainstay 7.5hp air conditioner were in 1957 when Daikin sent two units to Okinawa. With those exports as a start, OKK held an exhibition of refrigerator equipment on Okinawa in 1958 and established a sales agency there. Afterward, the company's export markets expanded to Taiwan, South Korea, and other countries. In the area of fluorine products as well, the company exported fluorocarbon to Okinawa to display in 1958 at an exhibition of refrigerating equipment. With those exports as a start, OKK shipped "Daiflon" gas to Taiwan, Hong Kong, Singapore, and South Korea. A little later, in 1961, the company received an order from Kuwait for "Daiflon" gas.

Daikin's exports began to expand in earnest from 1960. The total value of exports in 1960 was 37 million yen, but two years later the value jumped to 156 million yen. To cope with the increased exports, the company established an Export Section in 1963, and tackled the development of overseas markets. Daikin

was the company's new name by that time and in 1963 the company established an export section and began developing overseas markets. In 1966, Daikin established a technical assistance agreement with Delta Motors, the agent in the Philippines of a major Japanese automaker, and began the knockdown production of window-type and split-type room air conditioners. Its sales of those air conditioners proceeded smoothly and later the two parties agreed to broaden the product range of the technical agreement to cover Daikin's entire product line. Next, in 1969, Daikin entered into a technical agreement with Fred Clark Ltd., a kitchen equipment manufacturer in Australia, and established Clark Daikin Co. a joint venture for expanding the sales of Daikin products in Australia. In the following year, 1970, Daikin entered into a technical assistance agreement with Sung Juong Co., q1 a manufacturer of switches in South Korea, and began exporting the main components for packaged air conditioners for assembly production. The company's market share increased afterward until it eventually came to exceed 60 percent. By 1970, Daikin was selling not only air conditioners but also hydraulic equipment and had expanded its sales network worldwide.

In 1966, an Englishman named R. C. Higgs, the owner of an agency handling home electrical appliances, visited Daikin's head office and presented an enthusiastic and convincing case for Daikin to enter Malta. That visit tied directly to Daikin's entrance to the European market. Up to that point, Daikin had not considered entrance to markets in the Western countries, but the demand for air conditioners was expanding rapidly in Malta and if Malta were developed into a base of operations it would become possible to export to Western Europe and northern Africa. With the backdrop of that future potential, Daikin decided to invest in operations in Malta. As a result, Higgs established Daikin Airconditioning

R.C. Higgs at Osaka World's Fair in 1970 (left)
Daikin Airconditioning Company (right)

(DAC) in 1966. Then, in 1968, Daikin invested equity in DAC and the company became a joint venture. Daikin then began exporting air conditioners, water chilling units, and other items to DAC. Afterward, sales of air conditioners to countries in Europe expanded steadily, eventually accounting for a higher percentage of the business in Daikin's export division.

DAC conducted vigorous sales activities and established sales agencies in fifteen European countries, including Belgium, France, Great Britain, Italy, the Netherlands, West Germany, and nine other countries. Total sales in 1970 were 510 million yen. When the Expo '70 Osaka World Fair was held in 1970, Daikin hosted its first convention for overseas distributors, also in Osaka. Representatives from thirteen countries attended the convention, allowing them to deepen their business relationships. Around this same time, Daikin began considering building a plant for the knockdown assembly of air conditioners in Ostend, Belgium. EC unity was being strengthened and the outlook was clear that restrictions would be placed on exports into Europe from outside the EC area. For those reasons, and because it considered building a plant there, Daikin began an analysis of the situation.

There were many incentives for Daikin to enter Ostend at the time, including favorable tax treatment from the Belgian government. Also, the location Daikin was considering was conveniently located close to an expressway that cut across Europe, and a ferry connection was available from there to England, Daikin's main market in Europe. Land prices, meanwhile, were almost one-tenth the price of land in Japan where prices were increasing rapidly, and a quality labor force resided in the surrounding area. In 1972, Daikin and DAC jointly established Daikin Europe N.V. (DENV), capitalized at 25 million Belgian francs (175 million yen). Daikin provided 80 percent of the total capital. After President Nixon of the U.S. announced a halt to the direct convertibility of U.S. dollars to gold in August 1971, the Japanese yen appreciated rapidly. Since the yen appreciated versus the Belgian franc as well, the timing of Daikin's investment was outstanding

Newly Established Daikin Europe N.V. (DENV)

In January 1973, DENV completed construction of a plant with 5,000 square meters of floor space. The company then immediately began production of small packaged air conditioners, both water and air types. Because winters in Europe are mostly cold, the demand for air conditioners there is generally weak, and in the early 1970s no dominant European air conditioning manufacturers had yet emerged. As well, it would be a tremendous task to prepare the ducts and water piping required for air conditioning in the many historical buildings in Europe. Among its products,

however, Daikin had non-duct, separate type air conditioners, providing it a fine opportunity for an all-out entry into the European market. In these ways, entry into the EC market, centered on DENV, was shaping up to be the first step for Daikin to spread its air conditioning business globally.