



CEC Nameplate for Painting & Drying Equipment [10/557].

PART-4

METAL FINISHING Paintpots to Robots

Carrier

Finishing Equipment

Carrier

Continuous High Temperature
Enamelling
Process

Carrier

Nitro-Cellulose Finish-
ing Process

Carrier

Multi-Pass Oven for
small parts

Carrier

Paint and Varnish Dry-
ing Equipment

Carrier-Wagner

Continuous Automatic
High Speed Oven for
Tin Printing

CEC leaflet on Finishing Equipment, 1930s [10/570].

4. METAL FINISHING (PAINTPOTS TO ROBOTS)

This part of the CEC story is based on the documents listed in Section [10] of the References, and in particular on an abbreviated version of Archie Heard's unpublished manuscript [10/575].

In 1913, Buffalo Forge Company, USA, set up a company in Britain, headed by an Englishman, Stanley Laurence Groom. On a visit to the USA, Groom met with Willis Carrier who, in 1907, had formed Carrier Air Conditioning of America as a wholly owned subsidiary of Buffalo Forge. Groom returned full of enthusiasm with the possibilities of air conditioning, but Buffalo Forge, UK, had been set up (like the parent company) to carry out business in hot blast heating, ventilation and drying plants.

With the outbreak of war in 1914, the American Buffalo Forge decided to stop all installation activities and concentrate on manufacturing. The newly fledged Carrier Company was a victim of this policy. [The story of how Willis Carrier and Irving Lyle then set up their own company is told in Part-1.] Meanwhile, the English Buffalo Forge was engaged on war work and Groom was unable to promote his ideas for building up an air conditioning business. However, in 1921, Willis Carrier visited Europe, met Groom, and CEC was established in London [see Part-2].

Humidity control was the key to the improvement of many industrial processes. This was reflected in one of the company's original trademarks -"Manufactured Weather," and it was the motor car industry that desperately needed to improve its painting and drying methods.

Early motor cars were hand brush painted and over the oil-based primers and enamels came coat after coat of coach varnish. Each application needed to dry between coats, but when exposed to the atmosphere during drying, it picked up airborne dust. Thus, in addition to a difficult drying problem, there was a need for the drying process to be carried out in clean conditions. It took 36 hours for each coat to dry in the open shop and the process of finishing a motor car body could take two or more weeks.

CEC was able to combine Buffalo Forge techniques with the use of Carrier work in the USA on ejector air nozzles [a patented invention of Dr Klein of Carrier, Germany] to solve the problem of distributing high temperatures to provide acceptable differentials in the drying zone.

In 1921, the Vauxhall Motor Company was sold three ejector air conditioned drying rooms into which the painted car bodies were carried. Drying time was reduced from 36 to 8 hours with an improved finish, free of dust or fear of blooming. Moreover, the drying cycle could take place overnight. This was the first order received by CEC, London. It may have been a coincidence, but later in 1925, when General Motors acquired Vauxhall, their UK offices were located at 23 Buckingham Gate, next door to CEC. Soon, plants similar to that for Vauxhall were installed for Humber and for Salmson in France. This was to be the beginning of a long association with the car industry, not only in the UK and France, but worldwide.

It was Alex Fowler, originally of Buffalo Forge UK, who established personal contacts with many of the early pioneers of the rapidly developing British car industry. In 1923, William Morris (later Lord Nuffield) agreed to share the cost of sending Fowler to the USA to study how Henry Ford and others were beginning to carry out painting operations on conveyerised production lines. He returned with a know-how agreement between CEC and Drying Systems Inc of Chicago, a company prominent in mechanised high temperature stoving techniques, whose trademark was "Dry-Sys." One side effect of this association was that the London telegraphic address of CEC was changed from "BUFFALOES" to "DRYSYS" -the name which was eventually to become synonymous with car paint finishing.

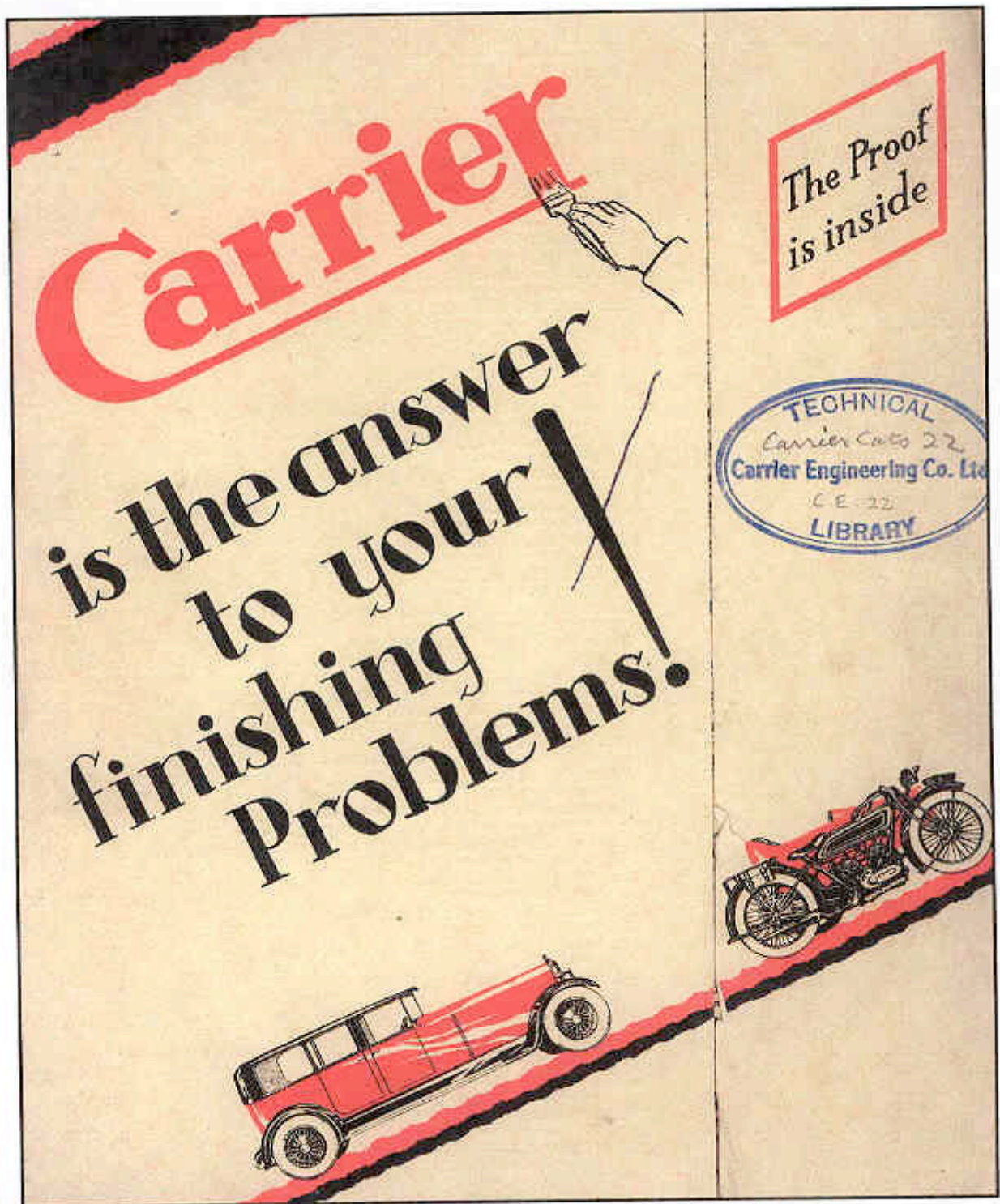
With Alex Fowler back in London, work began on the drawings for General Motors at Hendon, the first paint stoving plant built to use the new mechanised techniques. Lorry mudguards and valances were dipped by hand in vats of paint and hung from an overhead chain conveyor which ran intermittently, the painted parts being stoved in batches in box ovens.

The next advance came when three continuously operating cross-bar "camel back" ovens, the first of their kind in Europe, were installed for William Morris at Cowley to bake black enamel hand-dipped mudguards and other motor car parts.

In 1923, a branch office was opened in Paris by Rene Modiano. The business was to thrive and later, in 1929, Carrier Continental SARL was formed.

In 1922, Alex Fowler obtained an order for painting equipment from General Motors Continental of Antwerp. With the encouragement of Ed Riley, the American manager for GM, a young Belgian engineer Jean "Mike" Michiels was recruited from GM to be CEC's resident engineer. This was later to prove of great significance to the relationship between CEC and GM in Europe, and between Carrier Corp and GM in Detroit. On completion of the Antwerp contact, Mike Michiels worked in London before moving to Paris in 1929 to take charge of a large contract which Modiano had obtained from Peugeot.

With the introduction of cellulose finishes applied by "air brushes" (compressed air atomising spray guns) new problems emerged. Car bodies could now be transported through the paint at much higher speeds using continuous conveyors; curing temperatures were much lower; but the cellulose and solvents used in the spraying process were highly inflammable. To maintain factory safety, special ventilated enclosures were essential and particular attention had to be given to handling the cellulose paints and solvents.



CEC brochure, *Finishing Equipment*, 1930s [10/570, front cover].



Bonderite

HOLDS PAINT TO STEEL

Reg. Trade Mark.

The new chemical priming process for metal surfaces which ensures the permanence of the final finish.

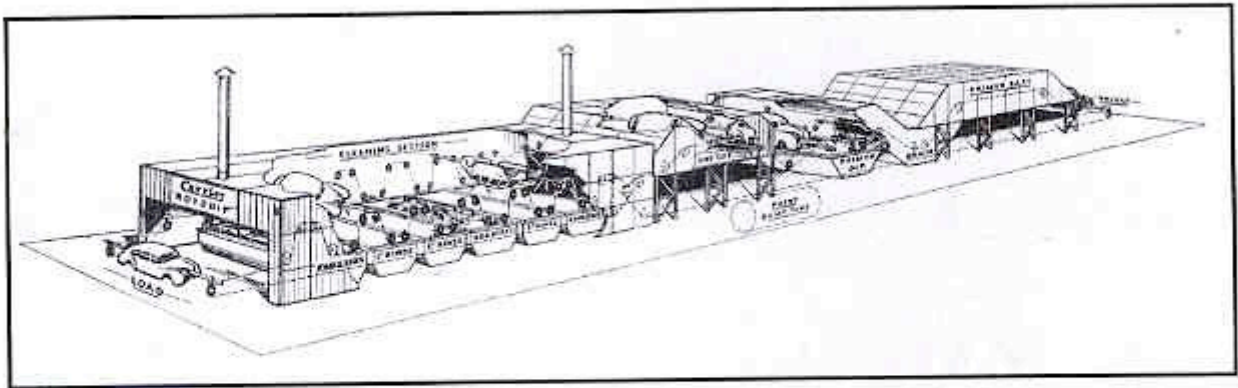
Can only be successfully applied by

**Carrier
Equipment
for
Bonderizing**

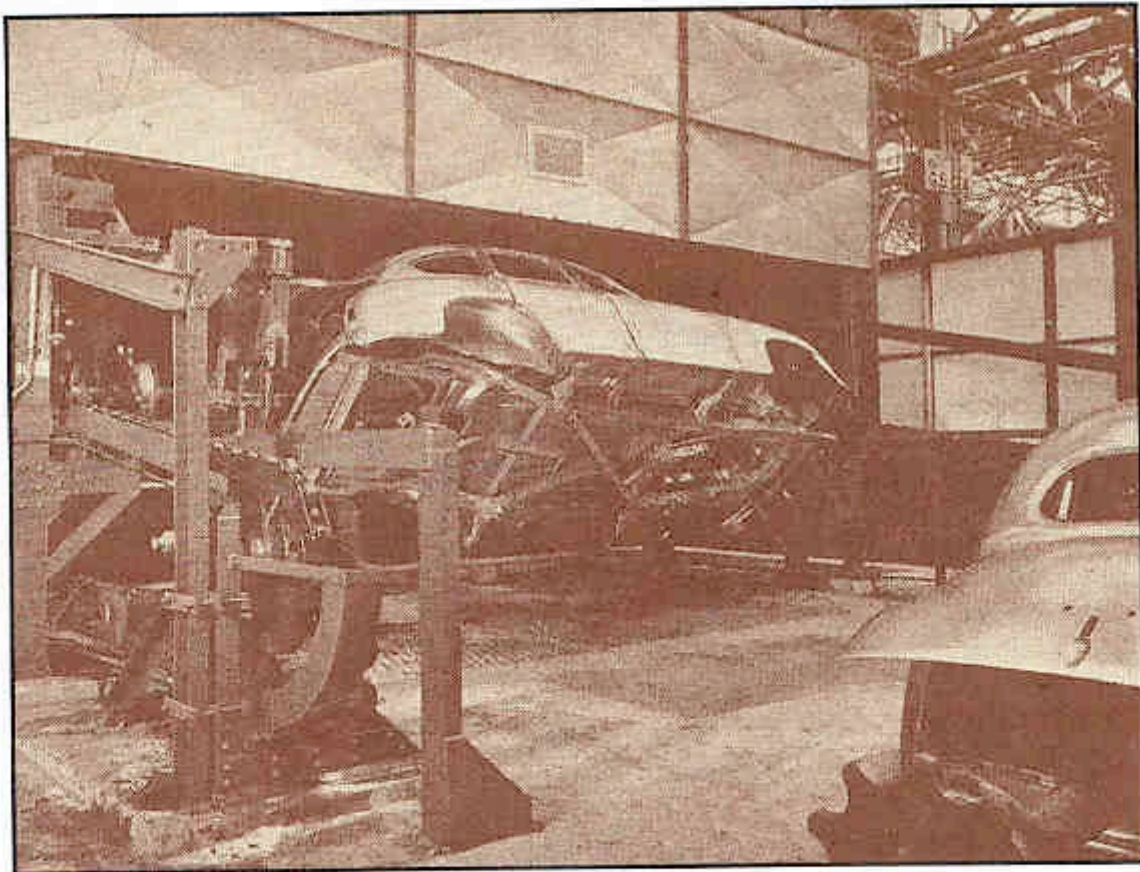
Carrier Engineering Company Ltd
24 Buckingham Gate, London.

The Bonderizing Process is protected under Patents owned by The Pyrene Company, Ltd., Numbers 270680, 270820, 346401, and certain pending patent applications.

Equipment for Bonderizing, 1930s [10/569, front cover].



Section through a Rotodip plant, c.1950 [drawing from 10/505, page 2].



*Car body (Standard Vanguard) at the loading end of a Rotodip plant, c.1950.
[10/505, 4].*

These enclosures became known as "spray booths". The amount of solvent evaporated required the removal of large quantities of air to maintain acceptable, breathable, conditions for the spray operators, and to avoid the accumulation of solvent vapour. Fire risks prohibited the use of direct fan extractors, so that a system known as "Evasé Ejection" was developed. Flame-proof electric motors and light fittings had to be employed while "make-up" air supply plants were required to replace the large air volumes extracted.

One of the first systems of this type was installed for Morris Motors in 1925. Then, in 1927, the first conveyerised plant in the UK for cleaning and painting motor car parts was installed, also at Morris Motors. By the end of the 1920s, a Carrier-Drysys mechanised paint shop would typically comprise a system of trucks, pulled by two chains, carrying car bodies through cleaning decks, primer and colour spray paint booths and tunnel ovens with hand wet-flattening and polishing decks.

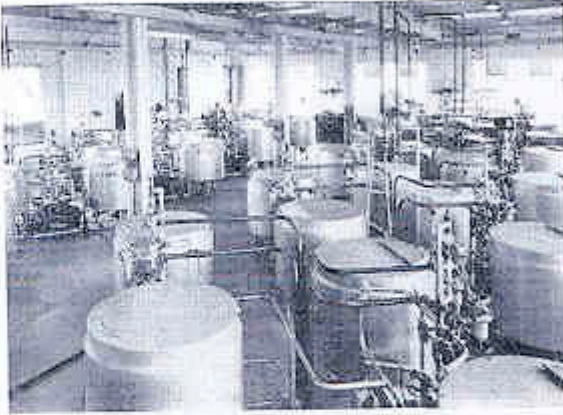
Carrier-Drysys also made agreements with the Wagner Company to build the specialised mechanical ovens used to bake tinplate sheets following lithographic printing.

During the 1930s, through Alex Fowler's contacts, CEC paintshops were built in numerous UK car plants: Morris, Austin, Wolesley, Vauxhall, Humber, Rover, Standard and Rolls-Royce; also for many suppliers to the industry: Kelsey Hayes, Pressed Steel, Fisher & Ludlow, Briggs Bodies and Car Bodies. In continental Europe, paintshops were built in France, Italy and Belgium for many famous names: Citroen, Peugeot, Fiat, Ford, and others. Plants using similar technology were built for painting toys, prams, bicycles, motor-cycles and other metal products [see Appendix-F].

Towards the end of the 1930s, synthetic enamels began to replace cellulose for motor car finishing. These had the advantage of drying glossy -"gloss off the gun" and therefore required no laborious polishing. This feature again highlighted the importance of good supply air filtration to the spray booths in which the final coats were applied.

One of the first European purpose-designed body paint shops to use synthetic paints was installed by CEC for Fisher & Ludlow in 1938. This included a comprehensive spray booth exhaust washing system served by a central station pumping and filtration station which included apparatus for disposing of the sludge and scum.

During the Second World War, CEC was employed on various engineering activities to aid the war effort [Part-2]. One development, by CEC in conjunction with Pressed Steel, was a plant for painting jerry cans, where these were rotated through the various process tanks of the pre-treatment section and then through the dip paint tank. Alex Fowler recognised the potential for this concept when applied to an all-metal motor car body. In 1944, a joint patent was applied for with his name as one of the inventors. The patent was granted in 1947 and the trademark "Rotodip" was registered. Fowler saw this idea as a solution to the problem of corrosion in the underbody of a steel passenger car body with an integral chassis. In addition, it would help solve the problem of corrosion taking place at the bottom of the doors caused by water running down the windows and then collecting in the door itself.

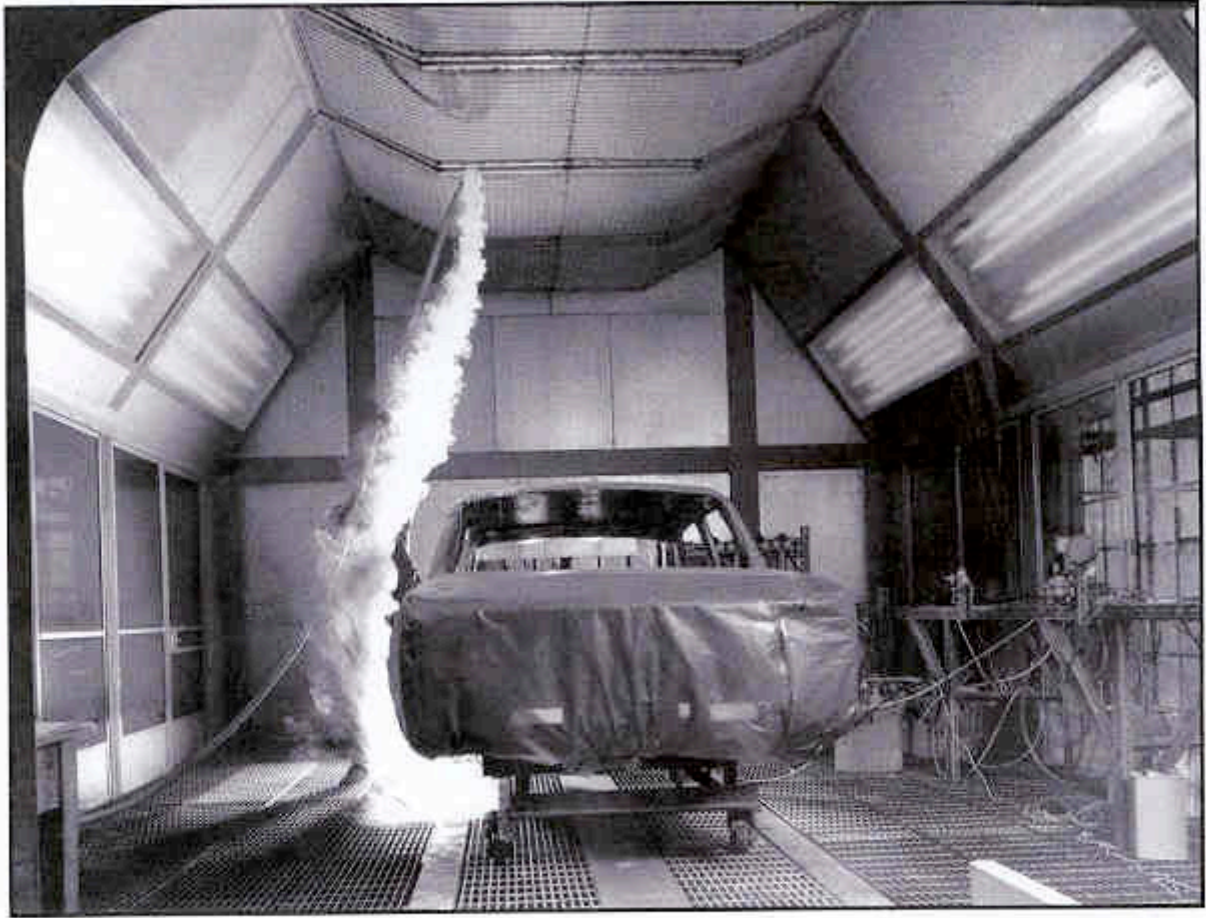


Engineering
from
Barrel
to Body
for the new
MORRIS
Finishing
Plant

CARRIER ENGINEERING COMPANY LIMITED

24 BUCKINGHAM GATE, WESTMINSTER, S.W.1. Telephone: Victoria 6858

Morris Finishing Plant, BMC, Cowley, 1958 [10/57, cover].



*Demonstration of non-turbulent airflow in experimental Hydrospin spray booth,
CEC R&D Centre, Acton, late 1960s [P-665].*

CEC went on, at its own expense, to build a pilot line capable of processing one car body at a time. Car manufacturers who were developing integral construction bodies, such as Pressed Steel (Morris Minor), Fisher & Ludlow (Standard Vanguard), and Volvo were persuaded to provide a body shell "in the white" which could be rotoprimered and then returned for final paint, trim and assembly. A completed car would be purchased by CEC and used on the road as a company car, regular inspections being carried out to check for any signs of corrosion.

The breakthrough came in 1946 with Rotodip orders for Volvo in Gothenberg and for Fisher & Ludlow in Castle Bromwich. It was one thing to design a pilot line, but quite another to build a continuous production machine capable of handling ten and twenty-five bodies per hour respectively.

The car bodies were carried on "spits" at right angles through the Rotodip plant, being rotated in the tanks of a six-stage cleaning and phosphate plant with intermediate flooding sprays on entering and leaving the process tanks. After passing through a dry-off oven, the body was rotated in a tank of primer paint before stoving. The rotation ensured very good penetration and draining in the pre-treatment stages and avoided the trapping and "refluxing" problems associated with normal dip painting procedures. A valuable feature was that the bodies could be processed from initial loading through to the "cool after bake primer" stage without being handled. This was the first major step to achieving full paintshop automation, and orders from Morris Motors, Wolseley and Austin quickly followed. An order for Vauxhall Motors in Luton was cancelled by GM Detroit because they decided it would be too great an investment to convert all GM plants worldwide.

The US firm of R C Mahon was licensed to handle Rotodip in the Americas, and one of their young engineers, Joe Donahue, was sent to England to acquire the necessary technical know-how. Donahue was later to become one of the original members of Schweitzer Industrial Corporation, but more about that later. The outbreak of the Korean War, with cutbacks in capital expenditure, and the development of the electrophoresis method of paint treatment stifled opportunities in the US market. CEC and experimental work by CEC on combining the advantages of Rotodip pre-treatment methods with electrophoretic finishing failed to achieve commercial success.

Parallel with Rotodip, Alex Fowler took out a patent and trademark for a system called "Rotospray" where the car bodies moved parallel to the conveyor, enabling the spray booths to be smaller, and by passing the car bodies through the ovens upside down the risk of dirt on freshly painted surfaces was reduced. CEC built Rotospray plants for Austin, Morris, Humber and Fisher & Ludlow, and secured orders from BMC in South Africa and Australia. In the USA, R C Mahon installed a Rotospray plant for Chrysler DeSoto.

Schweitzer Engineering Co (SEC) of Detroit had been founded in 1939, prior to which Howard Schweitzer had worked with Paasche, one of the developers of the airbrush. From spraying glaze on dinnerware it was a short step to spray painting various car body components. Scheitzer was joined by John von Rosen, a senior engineer at Chrysler Plymouth, with the aim to market automatic paint machines for the car industry, but the war intervened and von Rosen returned to Chrysler. Scheitzer made little progress until 1950 when he was commissioned by von Rosen, now a Vice-President of Chrysler, to design a body painting plant to be installed on the primer line of the new DeSoto plant.

Meanwhile, Alex Fowler had been encouraging the development of both Rotodip and Rotospray with the object of producing a system for the automatic application of top coats by a spraying or "flo-coating," a process for which he applied for a patent in 1948. When he heard from Schweitzer that the DeSoto machine was working, he commissioned SEC to design a machine for the UK market. In 1951, Harry Pitcher, who had joined CEC as assistant the Chief Engineer Putnam, was sent to Cleveland to work with SEC on testing the prototype. Schweitzer had taken out patents for the DeSoto machine but, to avoid possible patent conflict with CEC, he signed a marketing and know-how agreement with Fowler. In future SEC would concentrate on the North American markets while CEC/Drysys would deal with the rest of the car industry worldwide.

With this agreement, Fowler sold Sir Leonard Lord of Austin Motors, two overhead conveyor Rotospray paint shops complete with CEC-Schweitzer automatic spray machines in every spray booth. These plants were installed at Longbridge in 1952. Many thousands of car bodies were painted with all coats applied automatically with the exception of hand touch-in at the front and back.

In 1953, management of the embryo painting division, which had been started by Pitcher, was handed over to Howard Knight, who had been recruited from the UK car industry. In subsequent years, Howard became known as "Mr Automatic Machine" in Western Europe. Plants were built for Fisher & Ludlow, Humber Motors and Morris.

In 1957, Stanley Groom died and the Board of Directors of CEC was re-organised [see Chapter 2]. One result of this was the appointment of Archie Heard as Sales Director. A vigorous export drive was initiated. Tom Hardcastle made an extensive promotional tour of the United States, greatly assisted by contact with R C Mahon and Harold Schweitzer.

When Rene Modiano, the founder and Chief Executive of Soci t  Carrier, retired in 1960, CEC purchased his shares to bring their holding in the French and Belgium companies to 80%. Mike Michiels, who had been in charge of all metal finishing work, became President.

With the expansion of the business, CEC decided to set up R&D facilities at Acton. New paint finishing technology was developed for domestic appliances. Equipment was sold to Pressed Steel, LEC, Morphy Richards, Frigidaire, and International Refrigeration/Kelvinator in the UK, and to GM Gennevilliers (Frigidaire) in France. However, the R&D undertaking proved to be very time consuming for a relatively limited market and this experience emphasised the importance of concentrating the Drysys efforts on the car industry.

The increasing use of automatic paint machines, especially for colour, made it essential for CEC to be able to control all variables, both in the spray booths and in the paint mix houses. CEC spent money to refine the design of the paint distribution system which had previously comprised simple paint kitchens and pumping stations. They also developed their own multi-colour valves, combined with purpose-designed spray guns. As a result, CEC preferred to take overall responsibility for the entire paint plant, including the conveyors and all services.

To avoid conflict with the Carrier trademark outside UK and France, it was decided that car paint finishing work throughout the rest of the world would be carried out under the tradename DRYSYS. (This action was necessary because of the non-renewal of the agreement with Carrier Corporation, USA, in 1957. This also meant that the US company could not use the name Carrier in either the UK or in France.) The company "Drysyst Equipment Ltd" had been registered in 1948, mainly with a view to expanding overseas sales of tinsplate ovens. Now the decision was taken to trade under this name for all export business (including air conditioning) and Drysys Equipment Ltd became a wholly owned subsidiary.

These trademark difficulties meant that, for example, the plants supplied for BMC in Sydney, Australia, through 1956, 57 & 58, carried no nameplates at all. In fact, the first car body finishing plant to carry Drysys nameplates was for Innocenti in Italy. However, in 1959, a new agreement was reached with Carrier Corporation so that either party could trade in any part of the world, subject to the patent and trademark rights of the other.

By 1962, some 15,000 vehicles were being processed every working day in plants supplied by CEC-Drysyst, UK, and Societ  Carrier, France. Projects handled from London included complete paintshops for Morris, Austin, Rootes Group, Pressed Steel, Jaguar and Vauxhall; BMC in Sydney and South Africa, and SEAT in Spain. Meanwhile, Paris secured contracts for Citroen, Renault, Peugeot and Simca in France; Fiat, Lancia, Alfa Romeo, Auto Bianchi and Pinin-Farina in Italy. In addition, Mike Michiel's many personal contacts within GM led to orders from Opel and GM Continental, as well as for GM in Switzerland, Denmark, Sweden, South Africa, Brazil and Argentina. So now, the Company had established itself as the foremost supplier of paint finishing equipment in the world outside of the USA, and was poised for further expansion.

Visits were made to Czechoslovakia in 1960 and to the USSR in 1961. This would later lead to substantial contracts behind the Iron Curtain. An agency agreement was made with Mechanical Handling Ltd in Australia to develop the business there and in New Zealand. Meanwhile, Societ  Carrier, obtained an order, for what was to be the largest body paint shop in Europe, from Fiat at Mirafiori, near Turin. Drysyst from London provided a cleaning and priming line for Volkswagen at Wolfsburg. The years 1962 and 1963 were to prove to be ones that would transform the Company's business.

In 1962, Archie Heard and Harold Schwietzer embarked on a world tour to seek out export business opportunities. Their trip took in North America, Japan, Australia and India. One immediate result was the signing of a technical know-how agreement with Kenzaisha (later to change its name to Taikisha) of Osaka and Tokyo, forming an association that would last for over 20 years.

In 1963, SEC, to whom large royalty payments were being made, was purchased outright by direct negotiation with Harold Schwietzer. Applications to extend the registration of the Drysys trademark worldwide were challenged by Michigan Oven of Detroit who had purchased Drying Systems of Chicago together with their trademark "Dry-Sys." However, in 1964 a deal was struck. Michigan Oven withdrew their objection to the CEC using Drysys outside North America, while CEC agreed not to use the Drysys mark in the USA or Canada.

Drysys Equipment Italiana SpA was set up in Milan under Guiseppe (Pippo) Neri, previously a metal finishing consultant to Alfa Romeo. This new subsidiary was to exploit the paint finishing business in Italy but with executive control from France.

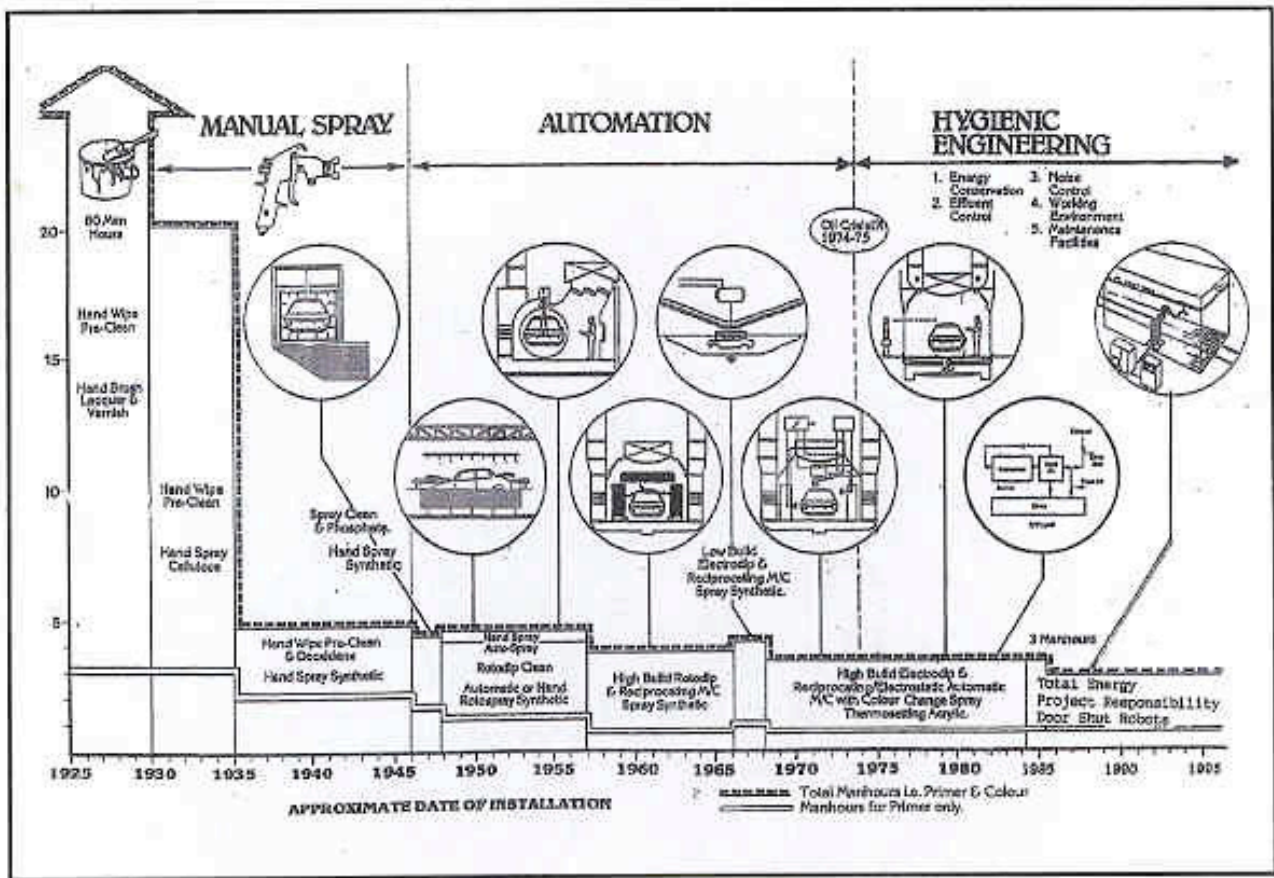
In Spain, Drysys Espanola SA was started in Madrid by Robin Purton in association with Urruzula SA, a Spanish paint manufacturer, with the latter holding a 75% interest. Some two years later, this arrangement was set aside and a new association was formed with Corch SA which enabled London to take full operating responsibility whilst complying with the then regulations on foreign investment.

The GM contract in South Africa, taken on a firm-price basis, proved to be unprofitable due to galloping inflation and exploitation by local suppliers. Therefore, on its conclusion Drysys SA Pty was set up, with Cator Love & Sons of Port Elizabeth having a majority shareholding. Later, Drysys SA became a wholly owned subsidiary of London.

CEC-Drysys continued to expand. They bought AID Ltd of Shenstone, a small English manufacturer of industrial spray equipment. This provided an outlet for the licensing agreement concluded with Nordson of Oberlin, Ohio, covering airless spraying equipment. Agreements were made in the USA with the Offen Company of Chicago for web-fed print drying plant, and with the Gasway Corp, also of Chicago, for specialised coil-coating equipment. The Offen arrangement was not a financial success, and neither was Gasway until control was transferred back to the States.

In France, Societé Carrier, built a large factory at Gravigny in Normandy. This was to be decisive in the winning of the huge Soviet motor industry orders that were to be the major part of Drysys France success at the end of the 1960s. The Gravigny complex included a well-equipped R&D facility, complementing that at Acton, together with a specialised Electronics Department.

Unfortunately, the 1960s saw a period of industrial unrest in the UK. Particularly damaging were the numerous unofficial strikes and disputes in the car industry. CEC-Drysys which until now had been free of problems with labour relations was caught up in this cycle of events and suffered its own troubles. Luckily, the overseas operating units were not affected by these UK events and profitable expansion continued.



Paintpots to Robots. The Development of Metal Finishing and its future as seen in 1980. [10/575].

Metal Finishing

The weak spots in Drysys world coverage were the USA, where Schweitzer was small, and in West Germany where competition was intense. Attempts to start joint ventures in these countries failed.

Meanwhile, Ford in the USA was working on the electrodeposition of water-based paints. At the same time, Pressed Steel was working with ICI on the development of electrophoretic painting and Drysys was invited to join this team. Also, the R&D department at Acton developed a revolutionary design concept for spraybooth washing systems which they christened "Hydrospin."

Fiat, acting as consultants, was appointed to build a complete car assembly plant at Togliattigrad in Russia to produce 200 bodies per hour. In 1968, Drysys France secured the contract for the major portion of what was to be the largest passenger car paintshop in the world. This was the first of a series of major installations for the Russians.

Other installations round the world continued: East Germany (agricultural machinery), Zanussi, Italy (washing machines), South Africa (metal roof decking), Singer Sewing Machines in Monza, Italy: as well as installations in Poland, Chile, Peru and Turkey.

The first few months of 1970 saw buoyant trading. The wholly owned subsidiary in South Africa won orders connected with the assembly of Toyota and Volvo cars. Drysys Australia was set up. A Drysys office was opened in Ausburg, West Germany. Work continued to be obtained in Italy, Spain and the Eastern Bloc. Then came what was seen as a major setback. In a hostile takeover, CEC was acquired by the building services contracting firm of G N Haden & Sons Ltd [see Part-5].