BUCKETS AND JEWELS - PLASTICS IN POST-WAR DESIGN

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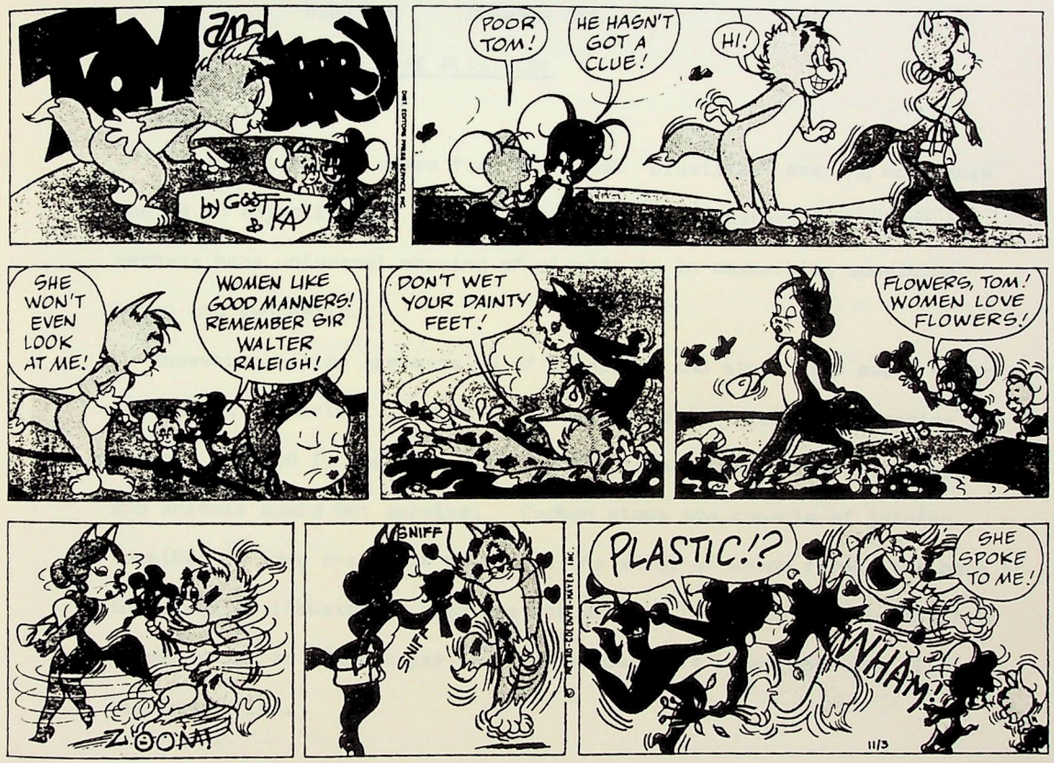
"plastic is the stuff of alchemy,....at one end raw, telluric matter,
at the other, the finished, human object....The quick change
artistry of plastics is absolute; it can become buckets aswell as
jewels....it is the first magical substance which consents to be
prosaic."

Roland Barthes
(Mythologies)

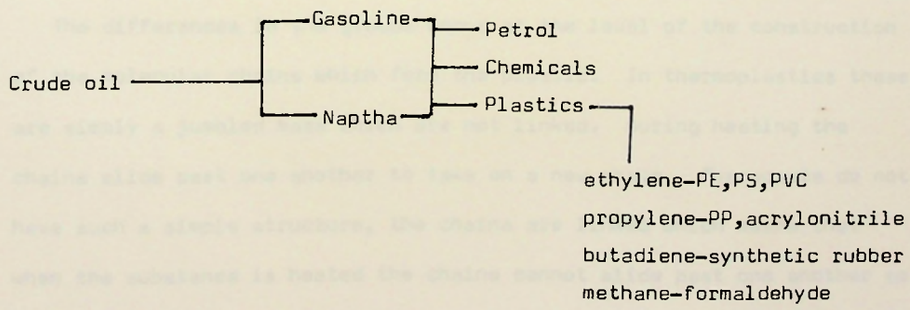

TOM and JERRY
by GOSTKAY
POOR TOM!
HE HASN'T GOT A CLUE!
HI!
SHE WON'T EVEN LOOK AT ME!
WOMEN LIKE GOOD MANNERS! REMEMBER SIR WALTER RALEIGH!
DON'T WET YOUR DAINTY FEET!
FLOWERS, TOM! WOMEN LOVE FLOWERS!
ZOOM
SNIFF
SNIFF
PLASTIC!?
SHE SPOKE TO ME!
WHAM!
11/3

PART ONE CHAPTER ONE.

WHAT ARE PLASTICS?

The word plastics comes from the Greek "plastikos" meaning mouldable and as an adjective has come to mean a mouldable material although a perhaps more universal meaning of plastic is in describing something cheap and synthetic..

However plastics are made up of molecules and atoms like every other substances on earth. Carbon is the molecule on which most plastics are based. Carbon is the molecule on which life is based without it plants and animals could not survive. Carbon atoms are capable of joining together in long chains of molecules the study of which formed the base of the plastics industry. Plastics are derived from petroleum in the form of crude oil or natural gas thus the industry is based upon the oil and gas industries.



The molecules occur as monomers which are then linked to become polymers which make up plastics e.g.ethylene polymerises to become polyethylene. Polymerisation can be done in two ways. The simpler form is Addition polymerisation in which polymer units are linked head to tail forming linear chains often with side linkages. More than one type of monomer can be linked in the chain and the resulting plastic is known as a copolymer. If three monomers are used the plastic is known as a terpolymer.

SAN(Styrene-Acrylonytrile) is an example of a copolymer while ABS(Acrylonytrile-Butadiene-Styrene) is a terpolymer.

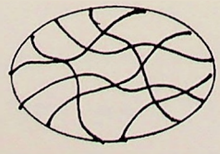
The other form of polymerisation is Condensation polymerisation in which atoms are removed and a molecule expelled(e.g.water) at each stage in the formation of the chain. Polymers produced thus are the formaldehyde based plastics e.g. phenol-formaldehyde.

Plastics can also be divided into two other groups: Thermosetting and Thermoplastic materials. Those plastics with bases in natural materials e.g.protein/cellulose can be treated so as to belong to either group. Thermosets are materials which are generally not as flexible as the thermoplastics and tend to be more brittle, subject to cracking and chipping on impact. Bakelite is a thermosetting plastic. These materials once removed from their moulds cannot be reprocessed, they will not soften under heat.

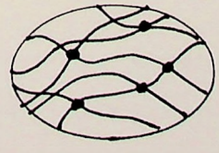
Thermoplastics on the other hand can be resoftened and shaped after they have been moulded meaning that they can be recycled.

The differences in the groups occur at the level of the construction of the molecular chains which form the plastic. In thermoplastics these are simply a jumbled mass which are not linked. During heating the chains slide past one another to take on a new shape. Thermosets do not have such a simple structure, the chains are linked which means that when the substance is heated the chains cannot slide past one another so the shape cannot change.

Thermoplastic



Thermosetting



● =links

Plastics can also be altered and varied by the addition of certain substances.

Plasticizers: which increase flexibility.

Fillers: for reinforcement e.g.wood flour, gless fibres.

Pigments / Dyes: to vary colours .

Stabilisers: make production easier.

Blowing agents: allows the plastic to be formed.

Catalysts: speeds chemical reactions such as polyuerization.

Flame retardants and static reducers can also be added to make plastics safer and more comfortable to use.

Plastics are versatile and as Chemists continue their reserches they become more so, fulfilling functions that men like Alexander Parkes and Leo Baekeland would hardly credit visionary men though they were in the field.

CHAPTER TWO

HISTORY

Plastics are often thought of as new materials, products of modern science and technology. This however is not really true. Many naturally occuring plastic materials have been in use for thousands of years, only recsntly being gradually replaced by man made substances in the last hundred years.

NATURAL/ORGANIC PLASTICS

Amber, an organic fossilised resin can be moulded when heat softened, and over two thousand years ago shellac was used as a varnish to seal timber, even today it is still used as a wood sealer in the craft of french polishing. It was also used by the ancient Eygptians and in China for sealing documents, until the introduction of the self-seal envelope it was commonly used for letters.

Shellac is made from a secretion of a tropical beetle "Coccus lacca". Deposits are collected from the trees where the beetle lives and melted together to form sheets, rods, or flakes. Its possibilities were first exploited by Emile Berliner in the 1880's when he was search -ing for some material which would be suitable for reproducing sound on the early phonograph. Shellac proved able to withstand long use without wearing plus good mould detail reproduction. Thus records proved to be the first automatically moulded products to be marketed. Such was the excellence of its sound reproduction that all pre-1930 records were made using shellac. After that they were gradually replaced by Bakelite and rigid vinyl which had improved strength. Eventually plasticised vinyl took over completely and long playing records replaced the old 78rpm's.

Other natural plastics which had been in use for centuries were also being adapted for wider usage. The protein plastics, from the protein material in animal and vegetable matter, include plastics made from milk, soya beans and substances like bone, horn and hair.

Of these casein, made from skim milk is the oldest having first been patented in 1885 in Germany although like shellac it had been used as a glue for centuries. Casein looked like bone and could be moulded in imitation and replacement of bone objects. It was produced in Ireland and England under the trade name "Erinoid"(because the raw material, milk came from Ireland) and initially it was used to make knitting needles and crochet hooks during World War I so that the women of England could do their "bit" for the boys in the trenches.

Casein was also machined into thousands of buttons and buckles in place of ivory and horn. It could also be laminated into spectacular multi-coloured marbled finishes and was adapted by using different coloured pigments and fillers to replace leather, bone, linoleum and horn. Also it could be converted into artificial silk yarn but this proved to be so weak that it could only be used with another, stronger, textile yarn.

Casein is still used to make fancy buttons but it absorbs water so it often distorts and cracks.

Other protein plastics by exploiting the properties of keratin which can be found in hair, wool, nails, horn and bone. Glues can be made by extracting gelatin from the bones of animals or by using dried blood. In the Middle Ages cattle blood and hair were often added to mortar to strengthen and bind it.

Such natural materials as horn can be pressed until it becomes transparant and as such was used as an early substitute for glass. In Washington, the Smithsonian Institute have a lanthorn dated 1740 two hundred years before Perspex was used to replace glass.

Plants too can yeild plastics, specially the cereals. During the Depression in America many people experimented with various crops in search of one which would produce a plastic. Among these was Henry Ford who began his search in 1930. He was enthusiastic about the

future of plastics in car manufacture and said:"No matter what we may guess as to the proportion of automobile parts that can be built from the fruit of the field our guess will fall far short of the eventual results".

He was rewarded for such enthusiasm because soya beans produced a plastic that he could use. In 1941 he displayed the worlds first plastic car. Although its shape was that of the traditional metal body car its exterior was made from soya protein fibre panels that had been hardened with phenol-formaldehyde resin which were then fitted to atubular steel frame. The plastic proved to have a ten times greater impact strength than steel aswell as being cheaper and lighter.

Unfortunately this new plastic proved to be hygroscopic like casein so its use was discontinued. However it, like casein and keratin had introduced plastics to the general public and made headway towards future innovations.

RUBBER

Another well known natural plastic is rubber, it is completely different from other plastics and has a history that goes far beyond that of todays plastics industry.

When Colombus discovered America he was fascinated by the games that the South American indians played with rubber balls, games which can also be seen in Inca drawings.

Rubber was not used in the old world until the late 1700's when an English man, a chemist named Joeseph Priestly marketed it as a graphite eraser. Then in 1820 it was discoverd that if a filler was used it could be moulded-however the result tended to deform easily, becoming sticky in hot weather and hard in cold. One adaptation that was a sucess was the compression of the natural latex gum between twolayers of cotten. The resulting material was rainproof and invented in 1823 by Charles Mackintosh. It gave the world a new noun and a new coat

- the mackintosh.

In 1839 the Vulcanisation process was developed by Charles Goodyear. Vulcanisation involved the addition of sulphur to rubber which was then heated. The end product could not be remelted or reshaped and it had gained an elastic quality which we today associate with rubber. Depending on the length of the process Goodyear found that the hardness of the product could be varied, even giving a very hard rubber which was known as ebonite or vulcanite.

Now at last rubber could be moulded. Solid rubber tyres were seen at the Great Exhibition of 1851, and in 1888 the first pneumatic tyre was developed by a Belfast vet named John Boyd Dunlop.

Vulcanised was good for insulating and was chemically inert. Thus it was suitable for containing storage batteries and acids. It was also put to less critical uses - buttons, jewellry, combs handles. All this inspite of the fact that it was black. Vulcanite was also adapted for dental use i.e. plates, tooth fillings, totally replacing tinted celluloid carvings.

Rubber, aswell as being different from other natural plastics, became through vulcanisation the first to be altered with chemicals. Rubber has also outlasted materials like shellac and casein, although its output dropped during World War II, and is still used today for articles like gloves, wellingtons and wet suits.

GUTTA PERCHA

Another material that comes from tropical forests is gutta percha which comes from the palaquim tree which grows in Malaya, Borneo and Sumatra. It is a hard, dark material which must be stripped from beneath the bark of the tree. Malayan natives used it to make sculptures and by 1843 these had been seen in Europe. The Victorians rapidly adopted it as a substitute for wood, leather and metals.

This new substance, depending on how it was treated, was both

thermoplastic and thermosetting, it could be rolled and cold moulded.

In 1850 the worlds first under sea telephone cable was laid. Gutta percha replaced the inefficient mixtures of wax and tar that had been previously used and held this function until the development (in 1933) of polyethylene which had better insulating properties.

Gutta percha was often used as substitute for bronze in decorative items as it closely resembled it in appearance. It also had good resistance to acids and other chemicals so it was used for early photographic equipment. But perhaps the most enduring use of gutta percha is in golf balls. In the beginning they were made from solid gutta percha and by 1900 the Gutta Percha Company were producing 100,000 golf balls a week. Now only the shell is made from it, inside which there twenty-five feet of rubber thread wound around a liquid centre.

This is almost the only surviving use for gutta percha although it is still used in America for dental fillings.

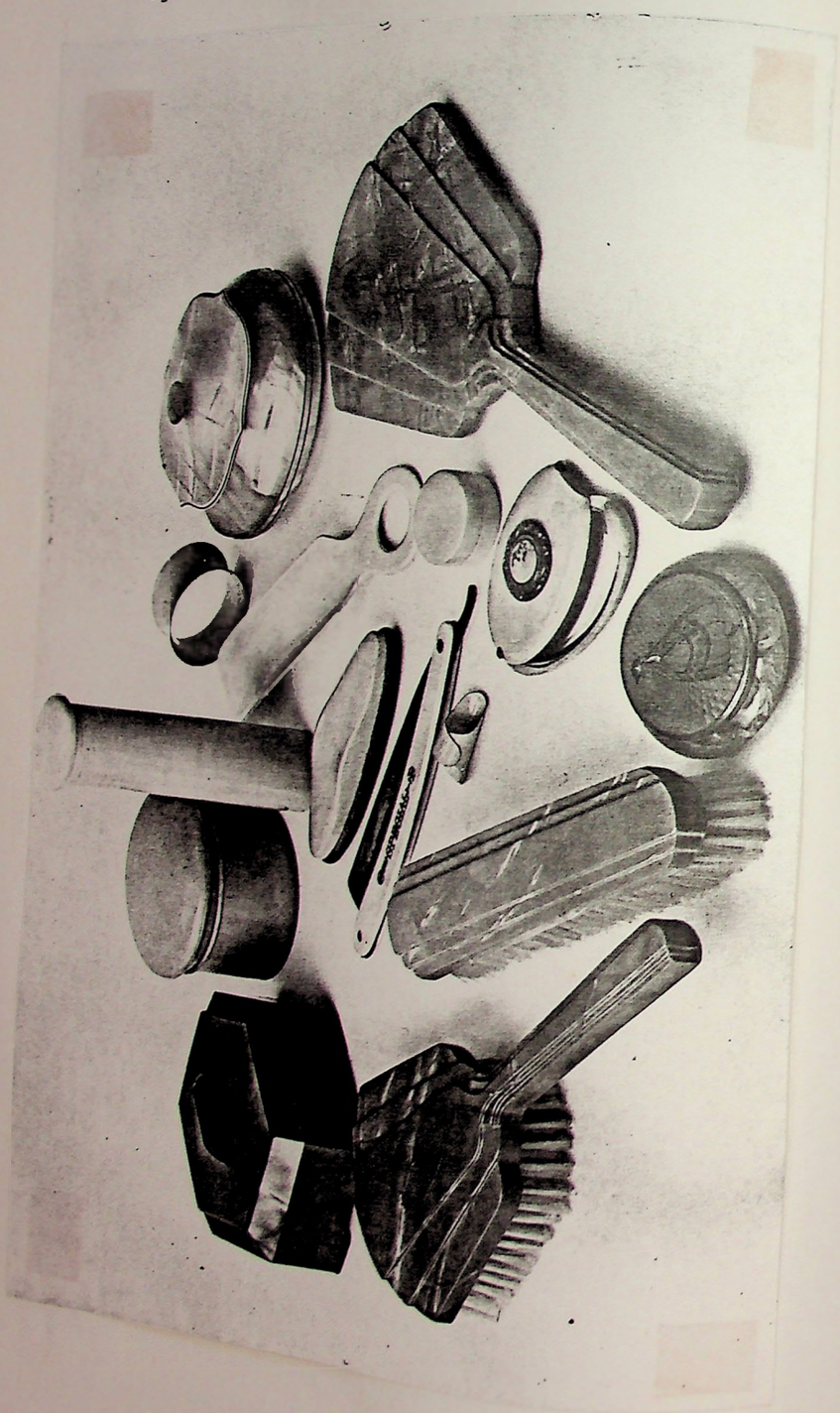
INORGANIC PLASTICS ; CELLULOSE AND RELATED PLASTICS.

Cellulose is an abundant raw material as all plant cells are composed of it - wood, cotten , jute. It was first produced by a French man Henry Bracconet when he combined sawdust and linen with nitric acid, producing cellulose nitrate. Some years later in 1845, at Basle University, paper (made from wood pulp) treated with nitric acid was patented as an explosive as it was extremely inflammable.

Although its base was a natural substance, these were the beginnings of the modern plastics industry and the fist man made plastics. Celluloid, depending on the amount of nitrogen in it, is highly combustible. Numerous early celluloid products were dangerous. Many burned necks were suffered by men who wore the new disposable collars and happened to spill glowing ash from a pipe or cigar on them.

Celluloids earliest commercial form, Parkesine, was produced in England by Alexander Parkes. In 1862 he was awarded a bronze medal at

Fig.1



International Exhibition for knife handles and combs. It drew much attention and was much cheaper to produce than rubber or gutta percha. Parkes saw his new material as a versatile replacement for many more expensive substances. "Buttons... shoe soles...sheets and other articles for surgical purposes". Parkesine could imitate sucessfully ivory, bone and tortoiseshell (fig.1.) aswell as being available in various colours - reds, blues, greens and oranges.

Surprisingly the Parkesine Company did not do well and in 1868 Parkes sold out to a friend, Daniel Spill. Spill proceeded to manufacture the material as Celluloid which was the name that it was patented under in America, where it had been developed by the Hyatt brothers. The Hyatts had taken the material a stage further, Parkesine was hard like a ceramic but with the addition of camphor it became more plastic.*1 This breakthrough was much encouraged by the fact that Phelan & Collender of Albany, New York, were offering $10,000 to anyone who could produce a substance that would replace ivory which the company used to make billiard balls. Having won this the Hyatts formed their own company. The Albany Dental plate Company produced dentures which offered people an illusion of reality by replacing the hard dark rubber ones that were currently in use.

Celluloid became increasingly popular as a replacement for tortoiseshell, ivory and pearl. However one of its most significant uses was as a transparent film first patented in 1889. Without it moving pictures might not have developed at the astonishing that they did. For inspite of its inflammability and the frequent fires that broke out the studios still turned out movies and the public clamoured for more. A new material

*1 Much of the Hyatts sucess can be attributed to their engineer Charles Burroughs. It was he who designed the tooling for the company. The moulds, machines and processes that he created were the basis for modern plastics production techniques used today.

had helped to produce a new art form.

Celluloids transparency was also exploited in the production of "safety glass" which was made from a layer of it sandwiched between glass. It was sometimes used on its own as in the eye pieces of gas masks during World War I.

Today celluloid has been replaced by less combustible plastics but it is still used for table tennis balls, dice, guitar plectrums and drum trim.

At the same time that cellulose nitrate was being developed cellulose acetate was discovered. Its advantage was that it was not flammable but it did not become available until 1911 when Charles Cross and Clayton Beadle produced what they called the Viscose Process. This allowed natural cellulose (a viscous solution) to be made into a fibre that could be spun and woven. This fibre became known as Viscose and is known today as Rayon.

Cellulose acetate was non-combustible because the cellulose was treated with acetic rather than nitric acid (acetylation). It took over many of the uses of cellulose nitrate - movie film, packaging and safety glass. Much later,in 1929, powdered cellulose was developed. It was the first time that a thermoplastic which could be injection moulded was produced. It was used for telephones and tool handles. Cellulose acetate was one of the first plastics which could be put to almost any use. Moulded it was used for handles, tubes were used to coat railings and it came to replace gless as containers for creams and lotions. Because of its transparency it changed packaging from something that enclosed to something that displayed.

In 1938 the Helicoidal Tower at the Paris International Exhibition was made from blue corrugated cellulose acetate sheet. Eighty metres high it was a tribute both to the material and its designers.

SYNTHETIC PLASTICS

The late 1800's saw the development of semi -synthetic plastics like celluloid but the early twentieth century would see the first totally synthetic plastics.

BAKELITE

In 1907 Leo Baekland, a Belgian who had moved to America, patented "bakelite". This new material was a phenol -formaldehyde resin which once cured could not be remelted. It was the first synthetic plastic and a versatile one. Both compression and injection moulding were possible aswell as machining after production. It soon became popular and inspite of it's dark colour (black or brown) it was extensively used between 1925-50 . Products both industrial and decorative were made from it.

It's excellent insulating properties made it suitable for switches and plugs and as it was hard wearing and held the details of a mould well it was used for machinery components. As it was inexpensive to produce it was used for containers for cosmetics and medicines but seldom for foodstuffs as it was thought that the formaldehyde base would endanger health.

Ashtrays, buttons and trays were also made and radio manufacturers began to use it for radio cabinets. The EKCO radio company in England started to employ designers to design radio cases in the new material. For the first time a plastic began to be exploited for itself lending to shapes which were curved and tapered to facilitate there removal from moulds. Plastics had at last graduated from bein solely imitations of more expensive rare materials.

UREA-FORMALDEHYDE AND MELAMINE

Bakelites dark colour was a drawback and in 1924 urea-formaldehyde was introduced. It was similar to bakelite but could be produced in white and various light colours. Until the development of polythene

and polystyrene it was the only cheaply available pale coloured plastic moulding material. This new material was used by the Beetle Products Company who displayed it at the 1925 Wembley Exhibition. The new products unlike bakelite were known by various trade names "Bandalasta" "Beatl", "Birmite", and "Beetleware". It was used for razor cases, vacuum flasks, talcum powder containers and in America Mickey Mouse tea-sets. It brought colour to the homes and tables of millions for the first time.

The first Modern Plastics Competion of 1936 encouraged much development in the technology of plastics manufacture. The winner in the industrial section was the Toledo weighing scales. This product was remarkable in many ways. Firstly it was moulded from a urea-formaldehyde material where as all previous scales had been decorated cast iron with seperate weights. Also it was spartan in its simplicity and it's casing which was the product of five years research was the largest single white moulding produced to that date requiring a 1,300 ton press which was over two storeys high. Inspite of the complexity and sheer size of the operation the new casing proved to be almost half the cost of the existing model.

Urea-formaldehydes great draw back was that it absorbed moisture leading to much of the table ware produced becoming crazed and discoloured.

A material which improved upon this tendancy was Melamine-Formaldehyde. As well as improved water resistance it resisted scratching, heat and chemicals better. Thus it could be used for domestic tableware and on electric appliances. It improves upon urea except that it is more expensive therefore it was used more sparingly as in decorative laminates like "formica" here only the top layer is melamine. Melamine mouldings were not common until the war when it was used for U.S. service buttons.

PVC (POLYVINYLCHLORIDE)

PVC was first noticed by H.V. Regnaunl as white powder in a test

tube. That was in 1835, but it was not until 1912 that it was produced in soft form to act as a replacement for rubber. In America it was made as a rigid plastic known as "vinylite". RCA - Victor used it to press records,even though it was more expensive than shellac, as it reproduced sound more clearly. It was further developed during the War when rubber was in short supply.

Unlike the other plastics developed before the second World War PVC is still widely used today for everything from raincoats to records.

PART TWO CHAPTER ONE.

THE FABOULOUS POST-WAR 'FIFTIES.

The 'fifties saw the worlds recovery from the austerity and hardships of the war years. People were ready to return to business of living. One benefit of the war was that plastics technology had become far more advanced when natural materials were no longer available. Materials like P.V.C. were improved and developed. Polyethylene was hurriedly perfected when rubber supplies from the East Indies were cut off, the Allies needed a replacement electrical insulator.

By the time the war was over the plastics industry was well advanced, ready to be adapted to provide for the consumer. Oil was now widely available so designers and manufacturers were freely exploring the possibilities of the new materials. Plastics was used to replace wood, ceramics, glass, leather, silk, wool and metals. Much of the substitution gave little thought to the properties of the new materials. Thus poor design, which did little for the credibility of plastics, was often the result. Some designers did realise that plastics had potential beyond replacing existing substances and they started a process of innovation that continues today.

HOUSEHOLD

Plastics had long been used in household goods. The bakelite radio was common in many pre-war homes, as were urea-formaldelyde beakers and plates. Celluloid was also commonly used for combs, buttons and boxes. So people were used to plastics in the house now, however new technology mean't that designers and manufacturers could be more inventive and instead of providing replacemeants that looked like wood and tortoise-shell they began to let plastics be themselves.

In 1951 A. H. Woodfull manager of BIP's product design department, won 1st prize in the Horners Award Competition. His entry was a childs highchair designed using urea and melamine materials. It consisted of a chair which was body-shaped and bolted to a frame with a removable

moulded melamine tray. The chair was the first to use the "moulded to the body shape" and it replaced a traditional material without imitating it.

It's carved edges throughout meant that there were no crevices to collect dirt and that in effect it could be hosed down if necessary.

Because of the toughness and easy cleaning qualities of plastics designers realised that they would be ideal for use in kitchens. Laminated such as "Formica" with a top surface of melamine-formaldehyde (resistant to heat, stains and scratches) were first used in kitchens when in 1949 the Electric Development Exhibition showed a kitchen in which the work-top, cupboards and drawers were faced with a laminate. Also included was a moulded sink and draining board in opaque "Perspex" which in transperant form had been used in cockpits during the war instead of glass.

Polythylene had been one of the successes of the war developments because it was flexible, odourless and non-toxic it proved to be ideal for use in the home and was widely used for buckets and bowls. It was also used for "Tupperware" products*1, a phenomonon of the fifties which is still with us to-day.

Plastic also leant itself to the styling trend of the fifties. Tapered and curved forms were easier to mould than sharp ones but they were also the forms of streamling wich was still popular in the early fifties in America. Alan Irvine's 1953 electric razor for Remmington with its two-piece moulded plastic body had curves reminisant of Loewy's cars which fitted into the palm of the hand. Here was an instance of the

*1 Earl C. Tupper was a plastics moulder who exploited the flexible and double qualities of polyethylene to produce a range of kitchen containers. They were very functional with an airtight lid and were produced in a variety of forms an translucant colours. In 1947 they were featured in an article be the American Magazine "House Beautiful" under the title "Fine Art for 39 cents."

Fig.2

Fig.3

material being particularly suited to the time in that the shapes which come most easily to the material were those that were popular with designers. (fig.2)

In 1951 Kartell was set up in Italy. The company was to lead the field in plastics design and provide encouragement for designers. The result being that Italy contributed much to the use of plastics in design. In 1956 the Castiglioni brothers designed the REM vacuum cleaner. (fig.3) The simple lines and bright colours exploited the material to the full and won for them the Compasso d'Oro award in 1957. In a similar field Gino Colombini designed a sweeping shovel (fig.4) in injection moulded polystyrene. This was a departure from the normal sort of dustpan in that it was long-handled meaning that the user did not have to crouch down when sweeping up dust so it could be used in conjunction with a long-handled sweeping brush. Again the use of simple lines and bright colour gave the design a freshness which it retains to-day, a characteristic of the best desins of any period.

Designers were also experimenting on a larger scale. In 1957 Alberto Rosselli designed a one-piece GRP moulded bathroom unit, although it was discovered that the one piece moulding was more expensive to install than seperate units.

FASHION.

Plastics have played a large part in what we wear. The earliest fibre differing from natural cellulose and with a plastic character was cellulose acetate which appeared on the market early this century. However it was not until 1931 that chemists at Bayer chemicals succeeded in spinning polyvinyl chloride into a non-rotting fibre. Then in 1936 an American chemist called Carothers produced a polyamide fibre which is to-day known as "nylon". This was followed in the next 20years by acrylic fibres " Orlon" and "Acrilon" and the polyester fibre "Terylene" which has the advantage of extreme strenght. (fig 5-9).

Fig.5

white nylon

with black velvet cowl

For name of nearest stockist write:
Roecliff & Chapman, 19 Grosvenor Street, W 1

Fig.6

Couturiers in

LONDON
PARIS
BERLIN

choose

ACETATE

CHRISTIAN DIO

sees in Acetate Duchesse
Satin the perfect medium
for a gown in the grand
manner. Lustrous, opule
it typifies the beauty of
fabrics containing

'Celanese'

ACETATE YA

BRITISH CELANESE LIMITED

Fabric by
ROBERT PERRIER of PAR
In London . . .
BRADFORD & PERRIER

Fig.7

Soft twin sets of ORLON keep their new look!*

Orlon
ACRYLIC FIBRE

DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING . . .
THROUGH CHEMISTRY

Have you heard of soft, soft twin sets that can be washed, without fear of shrinking? You *can* wash twin sets of ORLON again and again and without special care (they don't even need stretching and will not shrink). They keep their soft luxurious *new* look and their first-day fit. ORLON makes the perfect combination of *luxury and practicality*. Twin sets are just one of a great variety of good things to wear that are on their way to you (and him) in ORLON.

Soon available at leading Stores

* *'Orlon' is Du Pont's trade-mark for its acrylic fibre*

Du Pont, also the inventors of Nylon, makes fibres not fabrics or garments

Sole Distributors of ORLON in U.K. and Eire for E.I. du Pont de Nemours & Co. Inc., Wilmington, Delaware, U.S.A.

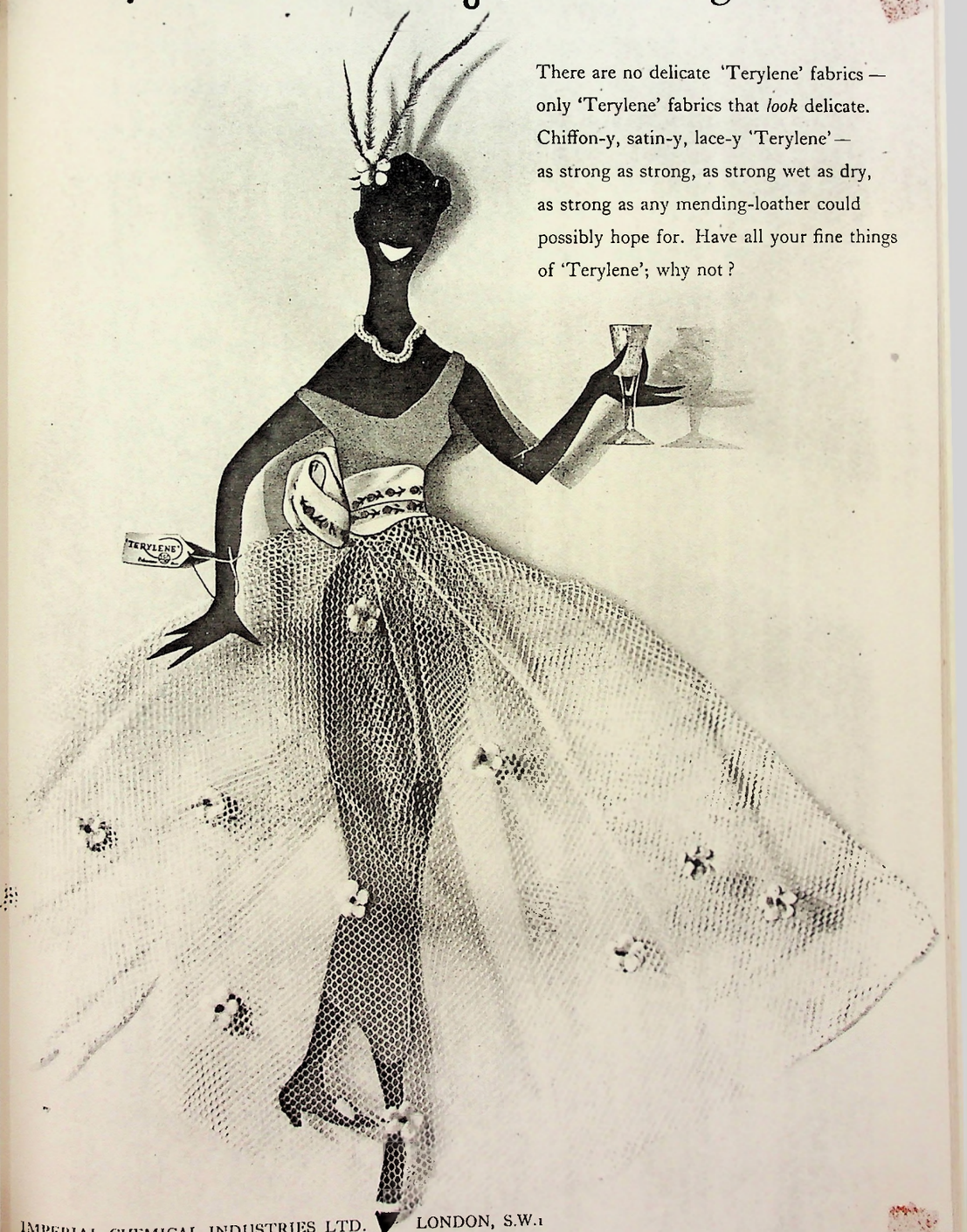
BROWN & FORTH LTD, Clifton House, 83-117 Euston Road, London, NW1 and 118 Charlton Road, Manchester 15

Fig.8


It's not mink
or beaver...
it's nylon genius!
Write for 'Pictures of Autumn Genius'
to J. & S. Bickley Ltd. Dept A,
91 New Bond Street, London, W.1
Hi! here's
high-pile
by LISTER

Fig.9

'Terylene' takes a **strong** line with a girl...



There are no delicate 'Terylene' fabrics — only 'Terylene' fabrics that *look* delicate. Chiffon-y, satin-y, lace-y 'Terylene' — as strong as strong, as strong wet as dry, as strong as any mending-loather could possibly hope for. Have all your fine things of 'Terylene'; why not?

IMPERIAL CHEMICAL INDUSTRIES LTD. ▼ LONDON, S.W.1

The advantages of these materials were that they were rot-proof, crease resisting and moisture resisting. (they dried more quickley). Also they were cheaper to produce than materials like silk and because they were polymers with high softening ranges creases,in the form of pleats could be pemanently moulded into them.

The new fibres,starting with Nylon, transformed the fifties wardrobe. For the first time thick jumpers could be made in white and pastel colours because the new fibres were washable, drip dry and capable of holding their shape. Fake furs, permanently pleated skirts and petticoats which stood up by themselves (no starching needed) also were available. Foundation garments were revolutionised, contributing to the narrow-waisted"waspie" look of the fifties. Nylon fabrics by their great strength and elasticity made possible the two-way stretch girdle of 1952. Companies making these garments benefitted greatly from the new fibres. One such firm, English Rose, went from thirty garments in their range in 1950 to ninety in 1956, mainly because of the availability of different kinds of synthetic fibre.

Unlike plastics in other consumer goods, the new fibres were wellcomed enthusiastically by everyone from the working girl to Vogue magazine which in 1954 published a glossary of the materials(man-made fibres) on the market. Manufacturers were proud of their achievments and advertisements from the period show that they were not trying to sell the fibres as simulations of wool and silk but as improvements upon them.

FURNITURE

Probably the first major innovation in the use of plastics for furniture was made by Charles Eames who, with Eero Saarinen had carefully studied the production techniques for moulded plywood chair shells. This experience was to be used in the production of GRP designs. GRP(glass reinforced plastic) is a combination of a resin(thick, liquid)

Fig.4

Fig.11

reinforced by fibres. The resin is usually polyester which has no strength on its own so the fibres, generally glass, must be added to give it strength. It is known as FRP(fibre reinforced plastic) in America.

In 1948, the first self-supporting one-piece GRP chair shell was designed by a team including Eames and his wife Ray for the "International Competion for Low-cost Furniture Design" where it recieved second prize. The shell was fixed to a frame of steel struts and was manufactured in austere colours of wartime gun metal and medium grey, light grey-brown. Eames did not choose the bright optimistic colours available as the Itatians did. A year later Eames designed the DSS side chair to complement the earlier one known as the DAR chair. Both are still manufactured to-day by Herman Miller with or without upholstery and on different bases.

In 1956 Eero Saarinens "Tulip" chair was produced (fig.11) Similar to Eames's chair it was the first design to produce a complete flowing form in plastic. Although Saarinens cheated a little in that the base was nylon coated cast aluminium, the classic beauty of the form was established and has often been repeated in slightly different form by other designers. It was the solution to a taske which the designer had set himself.

" I want to clear up the slum of legs" Saarinens reaction against the post-war trend for steel legs and struts every where.

Other peoples reaction to the "slum of legs" was to do away with them altogether. In 1952 Nanna and Jorgen Ditzel designed geometric block furniture. Modular units which could be built up according to the amount of space one had, were an almost unknown concept in the fifties. So unusual was the concept that the furniture was not put into production until 1966 when rigid foam was well established, and

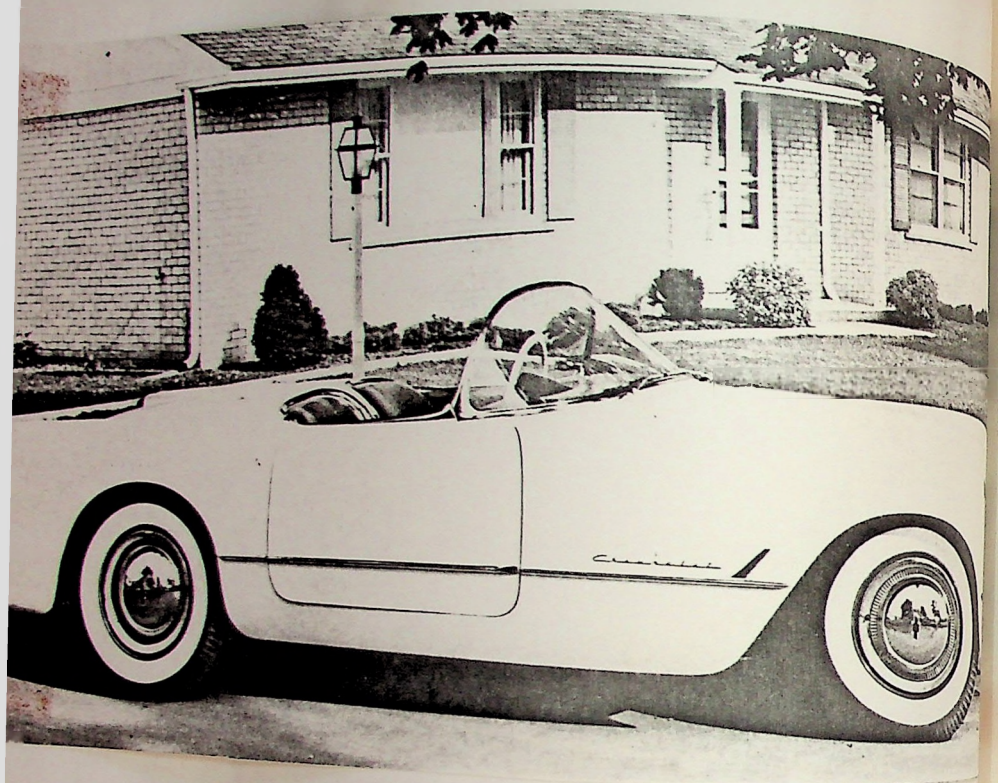


Fig.12

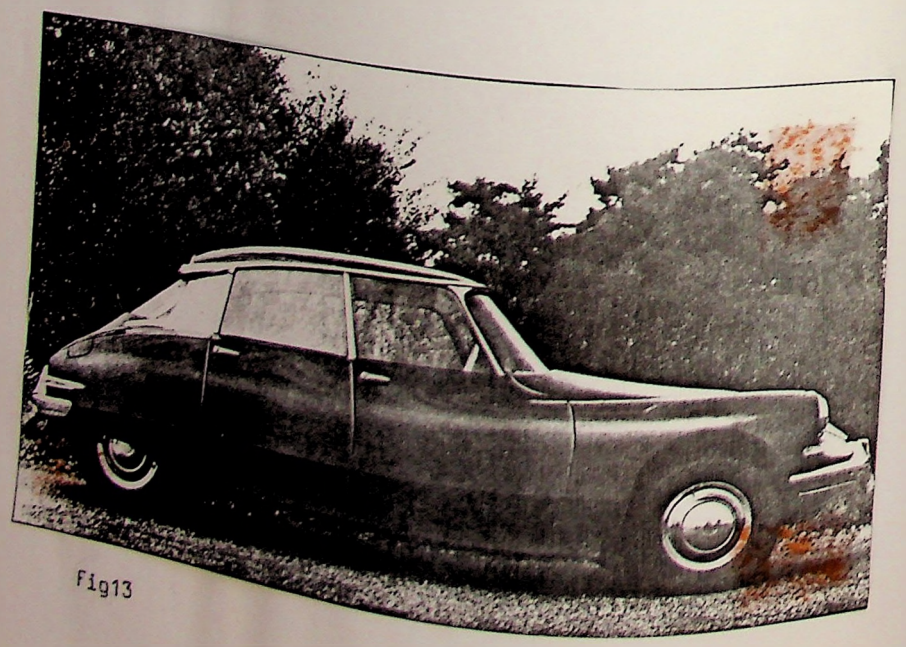


Fig13

modular furniture was becoming a standard feature of interior design.

AUTOMOBILES.

Plastics in the form of GRP had been used in cars for dashboards since the late 1930 and Henry Ford had experimented with soya derivatives during the forties. However GRP bodies were a post war phenomonon surfacing in 1980 in southern California to provide cheap novel bodies for elderly chassis. In 1955 the Chevrolet company brought out its new Corvette. (fig.12) It was the first production model to have an FRP body and it is a credit th the pioneering spirit of the company that they produced 30,000 units at peak annual production. Unfortunately due to short mould lives and problems with panel-fit GRP did not become widely used for whole car bodies. Many manufacturers did however continue to use panel of GRP in various applications on the car body. Citroen used them for the roofs of the D-series cars including the DS19 (fig.13) one of the most innovative cars of the 1950's and Singer used it for the bonnets of their Hunters (1955). Proving that man-ufacturers did appreciate the strength and non-corrosibility of the material even if they had not yet solved the problem of producing whole bodies of the single material, although for small production runs such as kit cars GRP is often used.

TECHNOLOGY.

During the mid-thirties, Dr J. Franklin Hyde an American developed silicone as an insulating lacquer. Silicone which is one of the most plentiful elements on this planet (found in sand) can when combined with polymer-forming carbon produce remarkable and versatile compounds. In 1943 the Dow Corning Corporation was set up in MIchigan to investigate the properties of the new material. It was found suitable as a hydraulic and lubricating fluid and could produce elastomeric mouldings in various forms from gel-like and soft to rigid and solid. During the war Dow Corning were the sole suppliers of silicone fluids and grease for military use.

However silicone took a different direction when it was discovered that if the insides of glass containers were coated with it, blood did not clot and water did not cling. It is now used as an inner coating for medical equipment. Silicone interested docters and scientists as it seemed possible that the material was bio-compatible. In 1950 Dow Corning used the first silicone rubber implant in replacing a urethra tube inspite of the fact that they had little information about the effect of silicone rubber in the human body. Fortunately the operation was a success and in response to demand a medical silicone rubber was compounded in 1953 known as Silastic S-97II. Then in 1955 the first commercial implant was designed. This was known as the Hydrocephalus Shunt and was used to drain spinal fluid from the brain. Since then the device has saved th lives of thousands of children.

Dow Corning were, by the late fifties so involved with medical applications that in 1959 they had to open a special department to concentrate on them.

One of the other developments which would prove popular for designers was the introduction of polyurethane foam around 1955. It can be produced in different grades and densities varying from rigid to flexible, hard to soft according to the strength needed.

Polyurethane is formed by exploiting two fundamental reactions of isocyanites:

1/ Isocyanate reacts with compounds containing hydroxl groups to produce the urethane links in making the polymerization chains.

2/ If water reacts with isocynate, carbondioxide gas and substituted ureas are produced.

Therefore if water and catalysts are present during production, gas bubbles will be released and trapped in the forming plastic. The resulting foam is known as expanded foam whih also has a further advantage "self-skinning", this means that objects can be produced in

"one-shot" processes that are fast and efficient.

Polyurethane because of its versatility quickly became one of the most indespensable of modern plastics. As well as coming in various forms of foam, it can be fibres, fabrics, elastomers and coatings.

The fifties were an exciting time when people were eager to experiment with the new materials available. Mistakes were made but there were success enough to change and improve peoples lives.

Homes were brightened by buckets and bowls in glowing colours. It was possible for ordinary working people to wear pale colours everyday thanks to the new drip-dry fabrics. Lives were saved due to the success of silicone rubber implants and thousands of new jobs were created by the expanding industry. So it was not merely a decade of Tupperware parties and pleated skirts but the youth of an industry which if it were suddenly to vanish overnight would leave us half clothed, half housed and half functioning in all areas of home and industry.

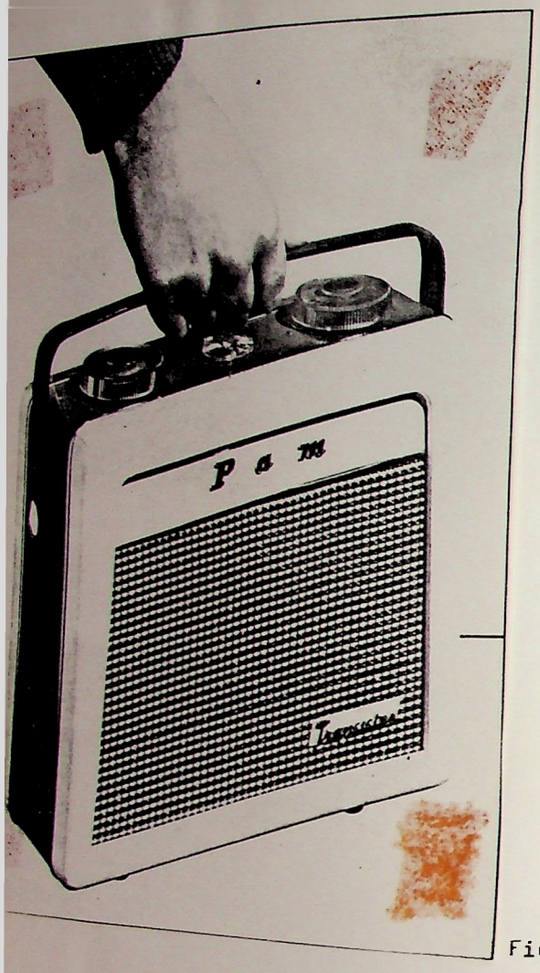


Fig.14

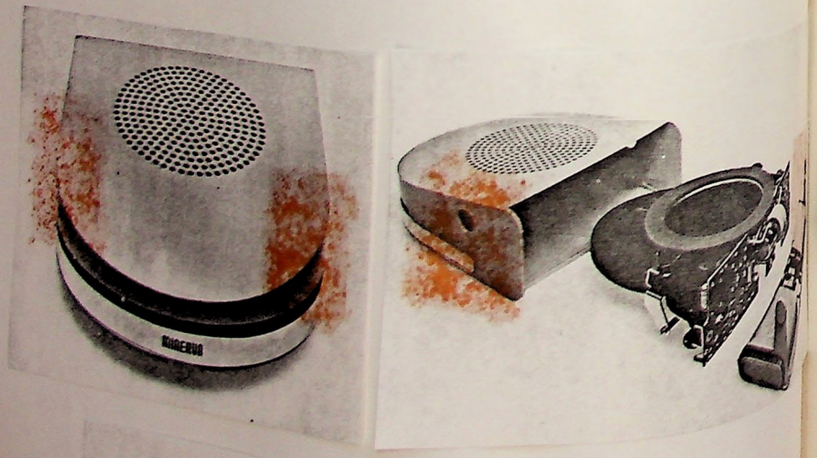


Fig.15

CHAPTER TWO

THE SWINGING SIXTIES.

By the time the sixties began the plastics industry was well established. Designers had begun to see what plastics could do and imagine how much more could be done.

Paul Reilly said in Design Magazine in January 1960. "we have just lived through ten very formative years in the history of modern design. Thanks to the spadework of the 1950's, the sixties could be a decade of remarkable achievement."

Manufacturers rose to the challenge by diversifying and improving their ranges of available plastic materials and most large organisations were anxious to put their money into plastics. Designers were also enthusiastic and many succeeded during the sixties in turning design concepts upside down which they could not have done without the help of plastics.

HOUSEHOLD

Plastics began to appear in more and more applications. Homes without several containers for all kinds of goods made in plastics had become extremely uncommon. Polythene reigned supreme on the packaging front because of its transparency, flexibility and non-toxicity. It was used for carrier bags and shrink wrapping food and as containers for everything from shampoo to bleach.

Miniaturisation was another characteristic of the sixties. Populations were growing; and living space shrinking. The transistor had been designed in the mid-fifties and in replacing the valve meant that people could now carry their radios about with them. *1(fig.14) Plastics were the obvious choice to provide housings for them.

*1 The first all transistor radio set designed and made in Britain was the Pam 710. Even this early model made use of plastics and its lightness and compact weight made the bulky pre-war radios totally outdated.

This interest in miniaturisation spread to similar areas combining of several functions in one unit or the miniaturisation of one function units. Mario Bellini's 1968 record player is an apt example of innovation and material explaitation. (fig.15) The record is slotted into the device like toast in a toaster and can be played in any position. The casing comes in two parts and one clips into the other by virtue of the resilience of the material without the need for screws or other types of fastenings.

Some designers started to use a newly perfected terpolymer, ABS. ABS (Aerylonitrile-Butadiene-Styrene) is a terpolymer made up by combining three petroleum derived monomers; aerlonitrile, butadiene and styrene. The material was discovered in the late forties and by varying the amount of each ingredient ABS resins of various properties could be produced.

By the late sixties this versatile material was better understood and it began to be vacuum formed into refrigerator door liners and wash basins. It is pleasant to the touch and returns an excellent surface finish which meant that it was particularly suitable for household goods. As early as 1963 the brittle acrylic post office telephones were replaced by more resilient ABS.

Other designs using ABS included a set of kitchen containers by Anna Castelli Ferrieri which by their solidity and simplicity set new standards in an area which had often been characterised by poorly designed almost throw away objects. There is also the BA 2,000 kitchen scale (fig.16) a classic of it's kind it was almost immediately selected for the permanent collection of the Museum of Modern Art New York. It is neat and compactly designed with a dual purpose weighing tray. Flat topped it can be used for dry objects and then turned upside down it becomes a dish for liquids or powders. On it's introduction it soon became a best seller 378,000by 1974 and establishing for ABS a reputation as one

Fig.16

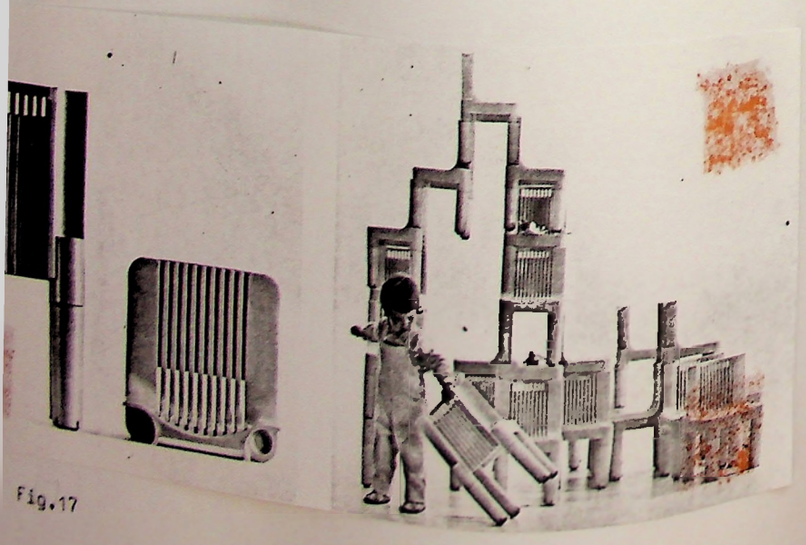


Fig.17

of the aristocrats of plastics.

However the designers of the sixties do not seem to have been primarily concerned with household items. Possibly the reputation such items had gained in the fifties made many of them wary of being associated with such objects. Those who did provided worthy additions to any kitchen.

FURNITURE

If household articles as a whole recieved little attention the same could not be said of furniture. Designers everywhere, specially in Italy, were engaged in an enormous wave of creativity which succeeded in changing peoples concept of what furniture should look like. A frame on four legs wasnolonger enough. If it could be folded up for storage or unfolded into a bed so much the better, the more it could do the better liked an item was.

Polythene and PVC had long been used for containers and packaging. Then in 1961 polythene was put to structural use for the first time. HDP (high density polyethylene) was used by Marco Zanuso and Richard Sapper for a childs stacking chair (fig.17) Polythene is well suited to the purpose as it is non-toxic, light, resilient and noiseless. The chair had seperately moulded cylindrical legs and for increased flexibility and comfort the seat and back were slotted which also allowed air to flow around the body. To stack the legs of one chair slotted into the back. This facility also allowed the children to build structures with several chairs as the material is very light. Thus what was primarily a chair was also a potential toy.

Other designers were not content with the limitations of working with moulded forms. In Denmark Gunnar Asguard Andersen experimented with foamed polyurethene using just the basic two-part chemical mixture building up layers poured from buckets on top of one another to form furniture of a sort. A chair of his made of ridgid polyurethene foam can now be seen in the Museum of Modern Art in New York. It was produced in 1964 and has been called "Acurious brown anti object which can still

Fig.18

be called a chair". (fig.18). It is even said to be comfortable to sit in.

The chair which is built up of layers of the self-coloured (brown) foam has a strange amorphous appearance like some creature from a science-fiction movie that has been petrified but might any moment come to life and lurch off into the nearest shadows.

In 1967 Lomazzi, DePas and D'Urbino produced the "Blow" inflatable armchair, (fig.19) a novel version of knockdown furniture it was made of transparent PVC which when inflated showed it s complete construction with nothing hidden. When not needed it couldbe deflated and stored away and being air filled with no sharp edges it was inexpensive and comfortable and much easier to move.

Other Italians were also being successful with various other new concepts. GRP had been the new furniture material of the fifties. In the sixties polyurethane foam took its place.

Gaetano Pesce used it in what is perhaps THE packaging and furniture innovation in the history of the industry.

The " Up " series of the late sixties expleited the fact that flexible polyurethane foam could have the air expelled from it compressing it to a tenth of its original size. (fig. 20) Thus the furniture was packed flat in sealed plastic envelopes which once opened let the air rush back into the furniture which sprang upto its original shape.

Piero Gilardi initiated what might be known as fun furniture with his Sassi series. These were globs of Guflex expanded polyurethane foam painted with Guflac laquer. The result was realistic looking boulder shape which because of weather and moisture proof qualities could actually be placed in the garden, like th real thing. Unlike the real thing they were soft enough to sit on, certainly a change from deck-chairs.

On a less frivolous level was Robin Day's polypropylene chair of 1963. (fig.21) Here the aim was to produce an all purpose chair at minimum

...er breakthrough in furniture design, the

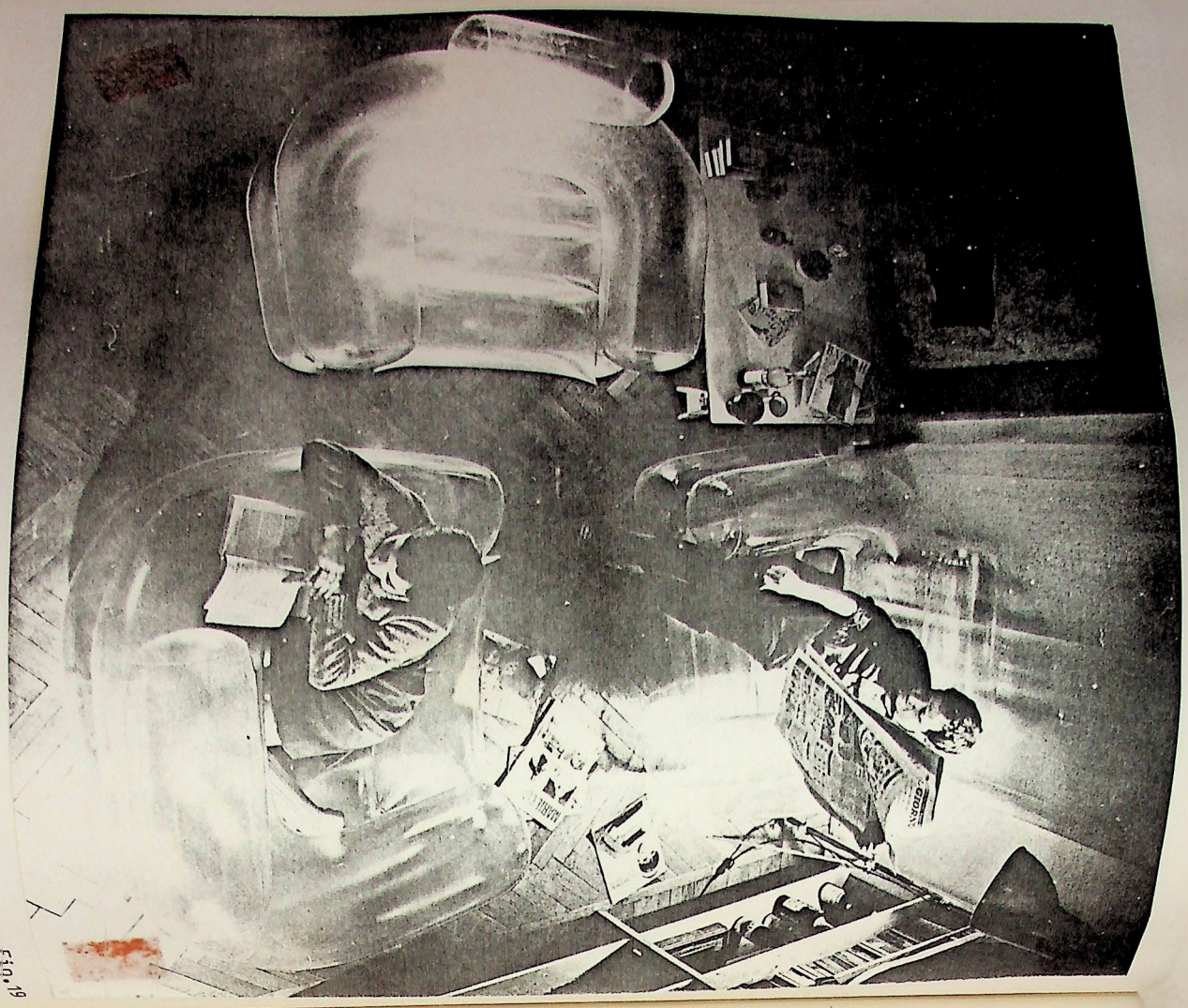


Fig. 19

Fig.20

Fig.21

first chair specifically designed to be, massproduced and injection moulded in polypropylene which was then a new polymer. Similar to Eames chair it was much cheaper and it is now made under license in fifty countries and had provided inspiration for many imitators.

Also beloved of sixties designers were modular storage and shelving systems. Systems like Joe Colombo's ABS injection moulded system which had six basic modules, four supporting rods and attaching hard ware which allowed for various combinations depending on what arrangement was preferred, making it ideal for the fast moving sixties where permanence was the last thing people wanted.

FASHION

The fifties had seen the emergence of synthetic fibres which although they did not pretend to be wool or silk were used and manufactured in much the same way. In the end they looked much like the materials they were replacing. During the sixties synthetics came into their own as fashion materials, as glowing glossy garments and accesories which were acceptable becaus they were plastics. Mary Quant *1 said in 1966. "We were the first people to use plastic as plastic. We wanted it to look like plastic. Key people in the fashion world were mad with excitement".

*1 Mary Quant was a product of Art School where she failed to get her art teachers diploma. However she was to become the "major fashion force in the world outside Paris". In 1955 she began her fashion career in the workrooms of a hat maker. The same year she opened a bazaar in the Kings Road. There she began by buying clothes in. But as she could not buy the sort of fashion she wanted she was soon designing and making her own to sell in the shop. Bazaar as the shop was known became a meeting place, a sort of "non stop cocktail party" with the clothes being bought almost before they had reached the rails. The Quant revolution had begun.

Fig.22

1966 proved to be one of fashions craziest years. Mary Quant had set the trend for the much copied PVC rain coat. But in Paris no one was concerned with anything so mundane. Space exploration was very much in the news and this seemed to inspire designers. Silver and white were everywhere and plastics seemed to be the materials which were suitably forward looking for the time. Paco Rabanne stole the show in Paris. Among his creations was a dress of plastic squares linked by metal rings and his "noen lit kite coat" which consisted of plastic diamond shaped on white crepe. (fig. 22)

Furs which had been simulated nylon were now boldly proclaiming their origns by coming in pinks, blues and greens.

Jewellery was also released from the limitations of precious stones and metals. Acrylic especially was appreciated for its bright colours and shiny surface plus the fact that because it was thermoplastic it could be shaped easily.

In 1967 ICI held a promotion exhibition of students work from the Royal College of Art. It was entitled Prospex 67 its purpose to promote the diversity of applications for perspex. It was a great success and before long work like Suzanne Fry's laminated rings were widely available and to-day many designers readily team it with gold, silver and other precious materials accepting the material for its beauty and versatility.

AUTOMOBILES

Car bodies did not progress much further in the 1960's but plastics had become indispensable in car manufacture. Because their lightness, non-corrosability and self lubricating tendancies they gradually became replacements for various parts of the car. Many materials were and are used and put to a variey of uses. Nylon is used in applications requiring tough accurate mouldings such as fuel-tank caps, cooling fans and water pump components. Acrylics because of their transparency are used for tail lights and head lights lenses and for sun roof panels.

Dash boards which began to be made in GRP in the thirties were being repaced by injection moulded ABS which can also be used for heater

Fig.23

Fig.24

housings, handles and inner door panels. PVC, and foamed polyurethane have replaced leather in upholstery and low friction polymers PTFE (polytetraflouroethylene) are used for bushings, gaskets and thrust-washers.

So although plastics were not immediately obvious in cars of the sixities, they were slowly taking over peripheral areas. Even today we barely realise how many small but vital parts of the cars we travel in owe much of their increased efficiency to plastics.

TECHNOLOGY

Dow Corning continued the pioneering work begun in the ''fities. One of their famous developments of the sixties were breast implants which replaced those made of synthetic sponge.(fig.23) They consisted of a seamless transparent sac of elastomeric silicone rubber gel with pieca of Dacron cloth attached to the back. The holes in the cloth allow the flesh to grow onto and around the implant so tht it becomes one with the body. The first implant is still inplace. The advantage of the new material was that its appearance was much more natural than the stiff early models.

In 1965 Robert Bosio, an Italien bio-engineer, designedthe worlds first acrylic artificial heart. Its was not much like natures model but it showed that man was determined to compete with her. Another area where man was more sucessful was the synthetic turf developed by Monsato in America. This imitation grass is manufactured in three grades, one of which,Landscape, is an open lattice of polythene bonded at different angles to a mesh backing. This "pretend" grass was first laid in the Houston Astrodome(begun 1960) and on many sports pitches since. Its great advantage being that it needs little attention - no watering or cutting.

The designs of the decade did much to increase peoples acceptance of and confidence in plastics. In many areas the substitution association was overcome, new shapes wih regard for the properties of the materials

were developed, new concepts were established. Furniture did not have to have legs, clothing did not have to look like wool or cotton*2(fig.24) earrings did not have to look like diamonds and gold. A sense of fun had been introduced into design, there had been a clearing out of the cobwebs to let the new ideas in.

*2 Perhaps one of the most enduring articles of clothing which we associate with the sixties is the plastic mac.

"Substute your lies for fact, I see right through your plastic mac".

(Substitute - Pete Townshend , The Who - 1966)

These raincoats, plain, patterned and transparent, were made from plasticised PVC. Cheap, cheerful, lightweight and rainproof they are still much in use today.

CHAPTER THREE

THE SCIENTIFIC SEVENTIES

The seventies saw plastics becoming a diverse and complicated technology. Plastics were being used in more refined ways. As in the fifties (but more realistically this time) plastics represented a synthetic technological future. Due to the oil crises of the decade the boom days were effectively over, post-war prosperity had led to too much plant being installed. Plastics had as a result tobecome much more sophisticated and specialised, because with manufacturers losing £100 for every tonne of polymer sold, every ounce had to count. Plastics were now replacing plastics and dictating new shapes and finishes.

HOUSEHOLD.

One of the big successes of the 1970's was the production of the all plastics electric kettle.

Kettles had been suggested as potential users of plastics such as polypropylene as far back as the fifties but it was not until the end of the seventies that success was achieved .

Hoover started using plastics in electric kettles in 1976/77 when they moulded the one piece handle and lid of a new kettle. Because of the mouldability of the plastic the remaining metal body was simplified in shape and manufacture.

Materials provided the first problem in designing a plastics kettle. Thermosetting types had long been used as electrical housings and handles but they were heavy, brittle and often colour limited. However what was necessary for a kettle was a material that had good impact strength and dimensional stability over a range of temperatures from hot to cold, and thermoplastics had long been weak under such extremes. Also necessary was a resistance to the grease, fats and oils that are foundin most kitchens.

Polymer technology came to the rescue in the form of polyacetal

Fig.25

Fig.26

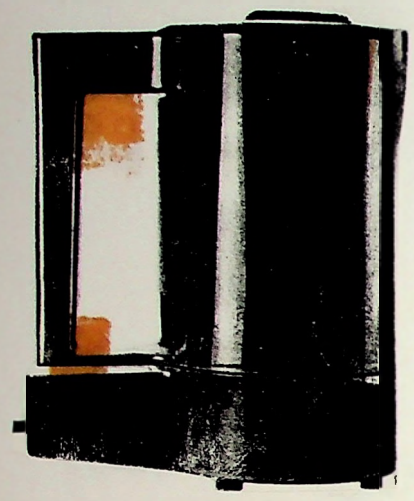


Fig.27

copolymer which had been used in plumbing applications and had good dimensional stability.

In 1978/79 Russell Hobbs decided to put its Futura kettle on the market when another problem was discovered. Free copper ions in some water supplies caused brown stains. Technology to the rescue again Celanese the manufacturer of the acetal copolymer were able to modify the material in order to avoid the problem.

Russell Hobbs were then able to launch the kettle with its whole body made in plastic. (fig.25). Michael Morecrofts the firms engineering director claims that the sculpted look of the kettle is the product of advanced injection moulding techniques and could not be achieved in metal.

Other manufacturers followed suit and now boiling jugs (the new kettles look more like coffee perculators) account for 8% of the kettle market and are expected to rise to 50% (fig.26).

FURNITURE.

Inspite of the many innovations in furniture it wa not until 1970 that the first chair to be entirely injection moulded was produced. It was designed by Steen Østergaard and manufactured in Demmark. The chair utilises the cantilever shape beloved of the Bauhaus designers but is made of glass fibre reinforced nylon. (fig27). A homage perhaps to old masters and new materials.

The chairs were weathe proof and could be bolted together to form rows and by using a simple stand twenty five can be stacked together. Foam cushions can be screwed to the seat.

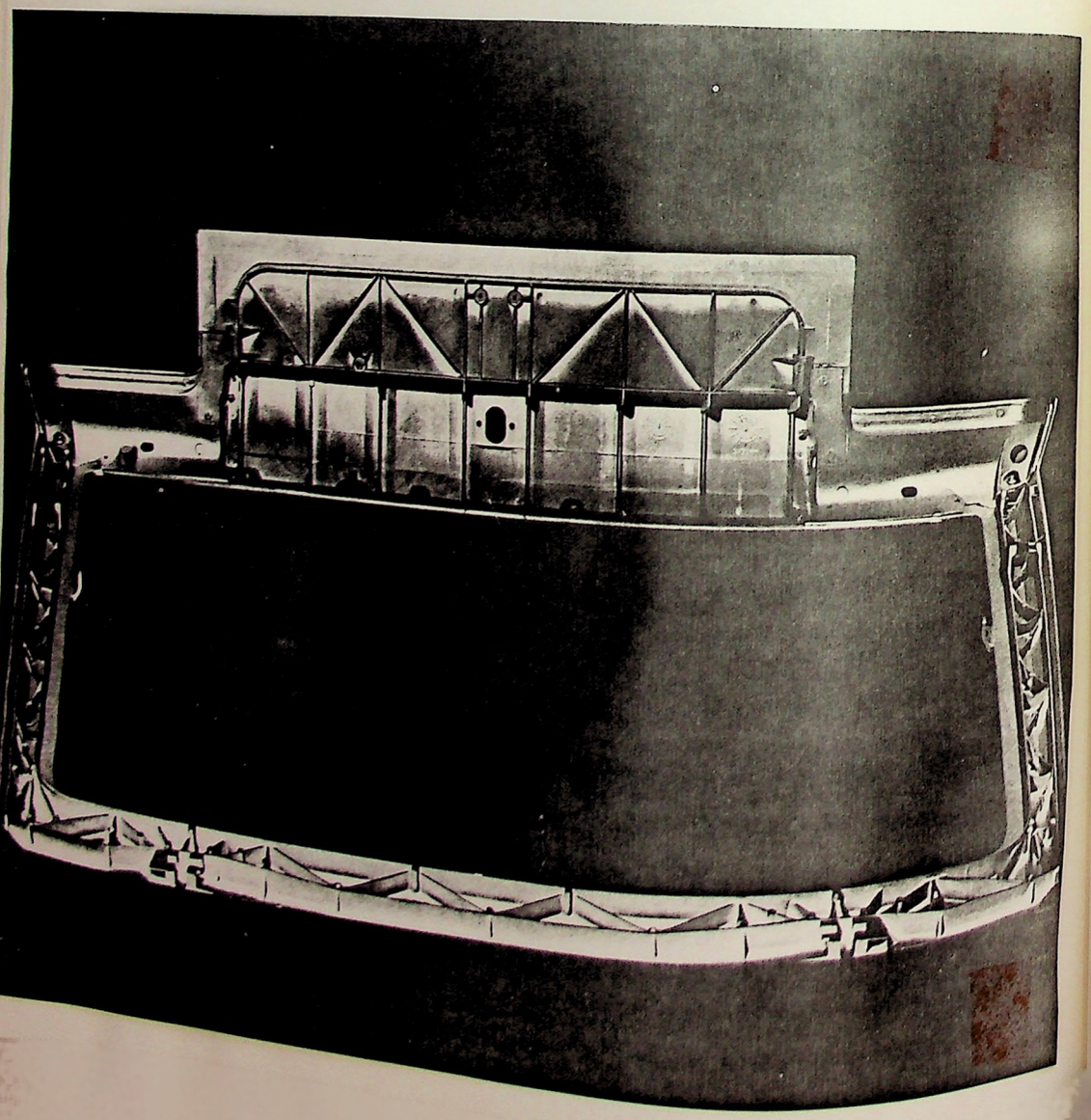
Further improvements like the structural foams meant that thinner sections could be used. Which in turn meant a change in styles, the generous forms of the sixties giving way to sparer shapes like Steen Østergaards Cado 290 chair.

AUTOMOBILES

During the seventies manufacturers once again began experimenting

Fig.28

Fig.29



with the possibilities of plastics bodies for cars. Many manufacturers began to study the subject closely. Among them were Citroen, long regarded as the individualists of european car design. Planning for their latest model, the BX, began in the mid-seventies.(fig.28) They wanted to move towards an sll plastics, mass-produced motor car. The resulting car, designed to be produced at a rate of 1000 units per day, has bumpers and airdams, bonnet, tailgate, rear quater panels, feul tank and head light bodies made of various plastics. Because of this the BX is 70kg lighter than the model that came before it, also it provides more shoulder room and cabin length. 10% of the cars weight is contributed by the plastics which is twice as much as in the previous model. Citroen see the use of plastics as a new direction which seems to be one for the future.

Plastics were used because of lightness, non-corrosion and impact resistance. The bumpers of polypropylene epdm have shock absorbing qualities that can take on impact of 5km/h without damage. Its tail gate is the worlds first in plastic and is injection moulded with its glass bonded directly to it. (fig.29). The bonnet is also a plastics first and is pressure moulded with primer applied during moulding. Thus it goes to the paint shop with the rest of the car. This means that there are no paint colour variations so when looking at the car one cannot tell what is plastic and what is not.

The BX has successfully integrated plastics into the car design and it is sure that other manufacturers will follow the lead and try to improve upon it which will further the use of plastics in the car industry.

TECHNOLOGY

It is only as technology progresses that we find uses and applications for polymers which may have been discovered years earlier.

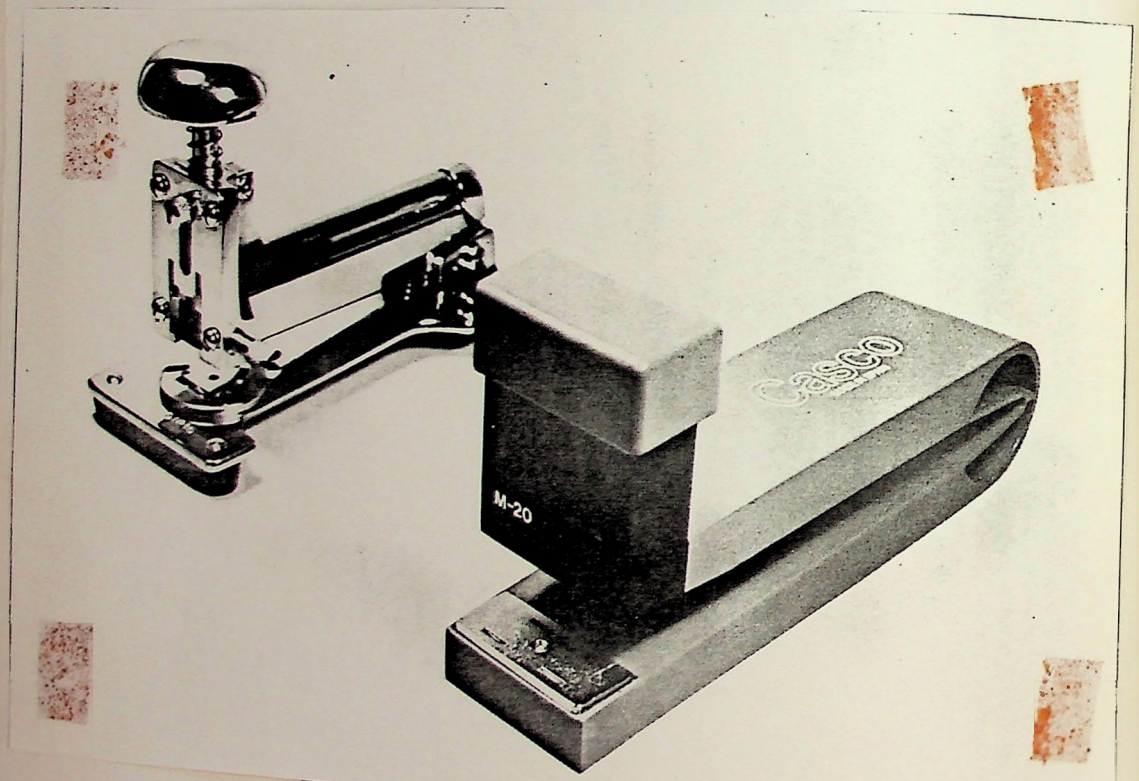
For example the emergence of a new class of aromatic thermoplastics

has proved valuable in many fields. These are much more stable than familiar conventional plastics and may be worked and formed at temperatures in excess of 300 degrees C. Such materials are expensive to produce but as demand increases they become more commercially viable. Which in turn allows the consumer to benefit from what was originally produced for high technology industry. Scientists can even change electrical insulators such as polyacetylene to current conductors. This can be done by adding to them substances which add or remove electrons from their molecules. Iodine when added takes away electrons leaving holes. When a voltage is applied across the material the holes move one way, electrons the other which constitutes a current flow. This has been applied at the University of Pennsylvania where researchers have produced a plastics battery.

Plastics have also provided the alternative for companies who felt that their existing products could not compete in the modern world. Among these was the Spanish firm EL Casco which had manufactured office accessories punches, staplers etc. for almost fifty years. The products were known as the most reliable and hardwearing, being made from dozens of precision die-cast and rolled steel shapes, all finished in high quality chrome.

However the company was having trouble by the early seventies as increasing numbers of cheaper lighter rival products appeared on the market and production coasts rose. Feeling that something should be done the company called in Estudio de Guillermo Capdevila to redesign the handle of their univereal numerator (used for numbering documents) Capdevila suggested that what was really needed was a detailed re-evaluation of the design of the whole product. The company saw his point and he was commisioned to redesign all the products in the range. What El Casco wanted were a range of products which would maintain their

Fig.30



reputation for quality and durability while materials and manufacturing had to be compatible with mass production. Also they wanted the products to be more usable their massive staplers had often to be used with a mallet.

Capdevila was sure that plastics would offer the best possibilities for cost and weight saving. Unfortunately the Spanish injection moulding industry was not used to working to fine tolerances. So he went to DuPont in Geneva who provided advice and experience to help in choosing materials and working out moulding details. High grade ABS and Delrin *1 were decided upon for the new range which was to be produced in black, red and white.

The new products had much to recommend them. The stapler was cut down from thirty seven parts to five with an interesting innovation in the hinge. The old model had a conventional spring loaded joint. (fig.30) The new one exploits the strength and resiliance of Delrin by having it integrally moulded into the body. After stringent tests two million operations over a four hour period the hinge showed no signs of fatigue.

The new numerator had much of its workings injection moulded in Delrin which together with the new casing brought the weight down by 60%.

Inspite of using high performance polmers the savings in the production of the range was large. In the case of the hand stapler production costs were two thirds lower than the previous model.

All the savings would not be passed onto the consumer but the articles would be cheaper and they were now lighter and easier to use.

*1 Delrin is a polyacetal homopolymer which has good friction and wear properties. As a homopolymer it is stiffer, harder and has a higher resistance to fatigue than a copolymer of the same material.

As can be seen the seventies were far more serious than the sixties. Economical factors played a part in this with industry no longer booming novelty was replaced by careful consideration of the materials and what they could do. Over investment during the late sixties and early seventies led to a gross imblance between supply and demand. New materials began to be developed which reflected the economic conditions. Cost effectivness becoming the prime consideration. People might still associate plastics with cheap and nasty but unkown to them plastics were becoming (in the top ranges) far more complex and expensive with the compensation being that they could do what no materials before could, the boundaries were being pushed further and further back but to where?.

CONCLUSION THE FUTURE?

Plastics provide designers and engineers with an amazing variey of materials; hard, soft, brittle, resilient, transparent, opaque. We can wear them, sleep and sit on them, travel in them. They bolster our egos and repair our bodies. They bewilder us with their diversit y until we are no longer sure what is plastic and what is not.

High performance plastics are used on the space shuttle and Boarings new 767 *1 makes extensive use of reinforced plastics materials making powered flight safer because the material is lighter. (fig.31) These same materials make almost non powered flight possible. In 1979 the Gossamer Albatross made the worlds first man powered flight across the English Channel. The air craft sponsored by DuPont Co. was made from super light, super strong plastics. The cords were made from Kevlar, a type of nylon, which is also used in the 767, the propeller was connected to the pedals by a polyurethane belt drive, the ribs were carbon fibre composites and polyurethane foam with an acetal pulley, and the cockpit was encased in nylon polyester film. The aircraft looks similar to some sketched by Leonardo and only needs a quarter horse power to keep it in flight. With the space shuttle at one extreme and the Gossomer Albatross at the other we would appear to be going backwards and forwards at the same time.

What has often been missing in the development of plastics products is integrity. Housings need not be just housings, with the internal components designed separately. Designs because of the nature of plastics could become more organic.

Traditional wooden furniture has integrity because it results from the users needs and the materials properties. There is no reason why plastics cannot be used in the same way. Attemp's have been made to do this. Olivetti's typewriters are cased in beautiful detailed housings which are not just housings internally they are carefully moulded with

Fig.31

*1 Black=plastics reinforced with carbon fibres.

Dark grey=Kevlar aramid fibres.

Light grey=mixture of fibres.

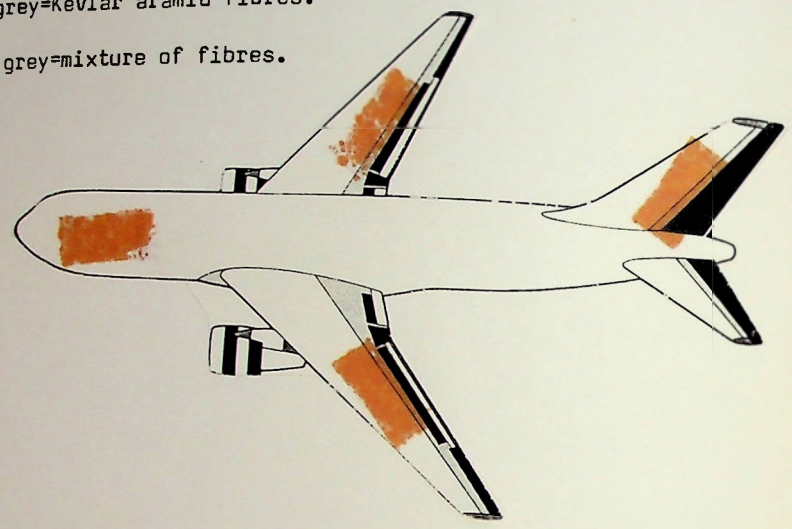
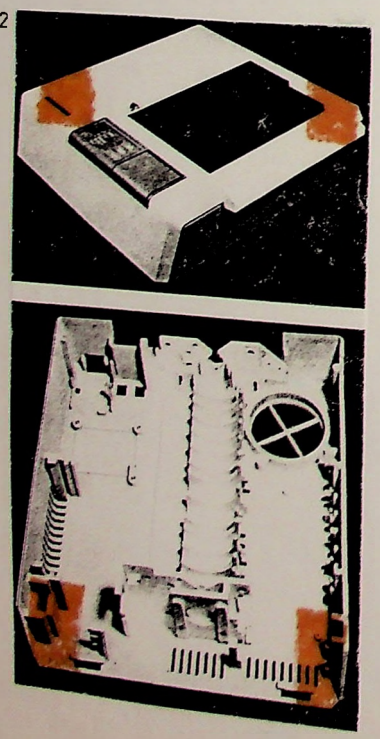


Fig.32



slots and connectors that support the internal components which in turn give the housing its strength. Many other companies now employ light, compact, clean looking housings on their products. (fig.32) Manufacturers of plastic materials make great efforts to make their product attractive to industrial designers realising the potential of the market.

But this is not enough. Finishes are still based on traditional wood and metal and internal components are still largely separate from their casings.

Plastics are by their nature stronger if moulded with rounded edges and gentle curves which should lend to gentler more organic shapes in products designed. The oil crises of the seventies have not stopped plastics production (they can also be derived from natural gas and coal). So it is time that plastics were given more serious attention if they are to be given the integrity that many people feel they lack.

What is really needed is for polymer researchers and developers to work more closely with people involved at different stages like the market researchers as well as mould makers, designers and engineers. Only when the people involved are aware of the whole design process can plastics emerge fromtheir fluctuating image of cheap and nasty to wonder material. By becoming accepted as diverse materials with applications in all areas, which have an integrity that can be tailored to the needs of its users, plastics will eventually leave behind any lingering ideas that they are merely replacements for something better and more expensive.

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